THE ENGINEER.

Shipping, Engineering and Machinery Exhibition at Olympia.

Descriptive Supplement No. I.

The Shipping, Engineering and Machinery Exhibition at Olympia.

THE thirteenth Shipping, Engineering and Machinery Exhibition at Olympia, London, opened yesterday, September 12th, and will remain open until September 28th. This show has developed a particular character of its own, which serves to differentiate it from other engineering displays. For a reason probably connected with the date at which it is held, it is in more senses than any other exhibition a social event. Coming as it does just at that season of the year at which the engineering institutions are beginning to open their doors for the serious winter meetings and at which their members are returning refreshed from holidays, it provides the first opportunity for engineers to meet again and renew acquaintanceships begun at summer meetings or during the previous winter sessions of their institutions. Moreover, Mr. F. W. Bridges, the organiser, puts himself to considerable trouble to make the way smooth for those institutions which desire to arrange meetings for their members for suitable functions within the Exhibition building, and year by year gathers together a particularly interesting group of exhibits.

Another character of this Exhibition is the manner in which on each occasion that it is held it has some particular feature or group of exhibits by which it can be remembered. Those who visited Olympia two years ago, for instance, are not likely to have forgotten the remarkable show of oil engines there gathered together. This year it is the addition to the main show of the Foundry Trades Exhibition which is likely to make the event memorable. The advent of manufacturers of foundry machinery and producers of foundry materials will enhance the interest of the Exhibition, and do something towards making up for the absence of a number of prominent electrical engineering firms which also abstained from exhibiting two years ago.

As to the exhibits themselves, we intend in this introductory paragraph to say little about them. It can be said with confidence that they reach the usual high standards of interest and excellence. Oil engines are particularly prominent, though less so perhaps than at the last Exhibition; but steam engineers need not fear that their field is neglected. To justify the use of the word "Shipping" in the title of the Exhibition, a number of firms are showing nautical instruments, such as compasses and echo-sounders and sextants, while a second group exhibits ships' auxiliary machinery.

In this Supplement, and another which will be published with our next issue, we endeavour to give some impression of what there is to be seen, and to direct attention particularly to anything of a novel character likely to interest engineers, whatever their own particular fields. Words, drawings, and pictures, however, are but a poor substitute for the real thing, and we advise all those that can spare the time to pay a visit to the Exhibition.

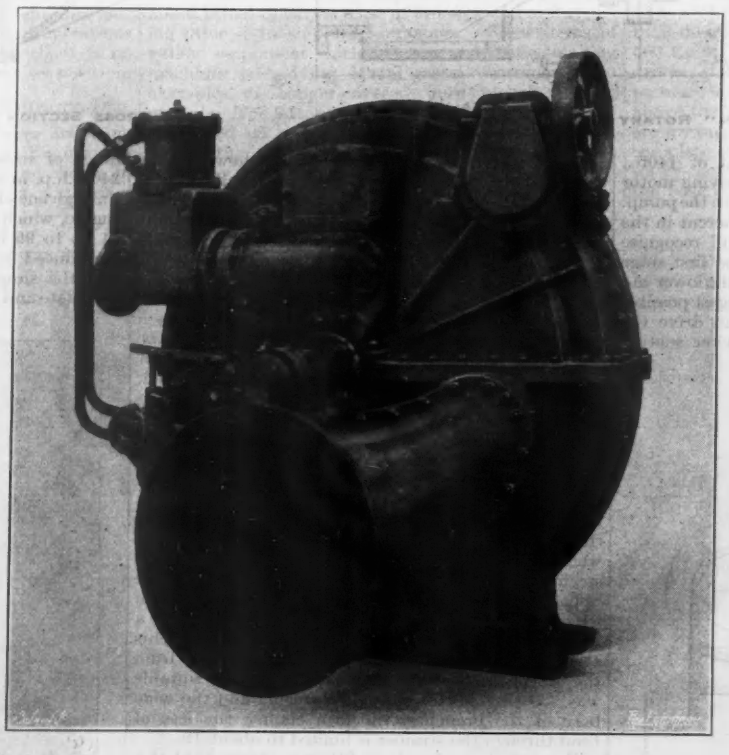


FIG. 1—ROTARY STRAINER—HICK, HARGREAVES

S. AND G. BROWN, LTD.

In an art Supplement with this issue the Brown automatic helmsman is shown. It consits of two parts, the bridge control unit, shown, and the power unit, fitted aft. When the vessel departs from the set course, the motion of the lubber line of the compass relative to the compass card results in a proportional movement in the repeater system. This motion is transmitted electrically to the step-by-step motor of the helmsman, which drives a contact drum through differential gearing. The contact drum completes the circuit of breaker switches which act as relays for the main circuit of the steering motor. The vessel's movement in returning on its course operates the power motor and the contact drum in the reverse direction, returning the rudder to its original position. Thus the compass circuit, in which is the drum motor, acts as an auxiliary circuit to the main circuit of the ship, which operates the steering motor according to the way in which the breaker switches are operated. In addition, an alarm relay is operated by this auxiliary circuit in case of current failure, which rings the gong visible on the right of the helmsman and throws up the switch shown locking the steering wheel. When this wheel is unlocked in emergency it becomes the means by which the human helmsman can take charge. Besides this automatic helmsman is shown the Brown gyroscopic compass, with its special bearing, multiple repeaters, and course recorder. In addition, S. G. Brown, Ltd., of Victoria-road, W.3, display their smaller gyroscopic compass for bridge installation, which overcomes the need for a repeater compass by an optical system.

BARR AND STROUD, LTD.

As in previous years, Barr and Stroud, Ltd., of Victoria-street, London, S.W.1, are exhibiting rangefinding equipment and prismatic binoculars. A typical example of a navigational rangefinder is illustrated in Fig. I of the art Supplement. For those previously unacquainted with such instruments, it may be explained that the principle is similar to that by which a man judges by the use of two eyes the distance of an object. Since the eyes are separated, although only by a short distance, it is necessary, if both eyes are to see the object, for the observer to squint very slightly. By so arranging an optical system that the points from which the two observations are made are more widely separated, the angle of "squint" for any given distance can be increased and accurate means of measuring the angle can be arranged upon the system. In rangefinders of this type made by Barr and Stroud, Ltd., rays from the object are collected at the two ends of a long tube and reflected along it towards the centre, at which point the observer brings them to foci in eye pieces. The arrangement is such that one eye sees the object through one end of the tube and the other through the other end. Moreover, the optical system is so arranged that only one-half of the object is seen in each tube. Thus, for instance, the upper part of the mast of a ship may be seen by one eye and the lower half by the other eye. When first viewed, it is probable that the two images will not be collinear, but by the use of adjustments provided, reflecting prisms in the instrument are slightly rotated and the images become collinear. This adjustment is equivalent to altering the angle of "squint." The distance of the object can then be read off a scale on the instrument. For greater accuracy, each of the two optical systems is constructed as a telescope.

Included among the binoculars there is a 7×50 instrument, which has been adopted by the Admiralty for general use in the British Navy. This glass has not only great light-gathering power, but is also claimed to give the highest percentage of light transmission that has ever been attained in binocular design.

HICK, HARGREAVES, LTD.

On the stand taken by Hick, Hargreaves, Ltd., of Bolton, there is on view a large amount of equipment connected with steam power. In Fig. XII of the art Supplement we reproduce a photograph of a 600 b.h.p., high-pressure steam turbine to run at 6000 r.p.m., similar to that which is being exhibited. The picture indicates how a turbine of this nature can be coupled through suitable gearing to an electrical generator, but, in fact, at the Exhibition, the machine is shown alone. This form of the firm's products is so well known that we need make no further reference to it than to direct attention to the neatness of the design.

The firm, besides manufacturing small and medium-sized turbines, also produces auxiliary machinery, such as centrifugal pumps, condensers, air ejectors,

&c., for much larger plant, and this sphere of its activities is well represented. The line engraving, Fig. 3, shows a section through a Hivac two-stage condensate extraction pump. The example actually exhibited, Fig. 5, is one of those which will be installed in the near future in a large power station close to London. It has a duty of 450,000 lb. it is under pressure, so that there is no possibility of air leaking in at this point and "choking" the entry of water into the pump from the condenser. Air-ejector equipment made by this firm was described recently in our columns in a series of articles entitled "The Surface Condenser," and we need only mention that a two-stage Hivac ejector is exhibited. has been specially developed for use in mines or other situations where space is limited.

GLENIFFER ENGINES, LTD.

From the group of engines displayed on the stand of Gleniffer Engines, Ltd., of Anniesland, Glasgow, we have chosen for illustration two models out of a

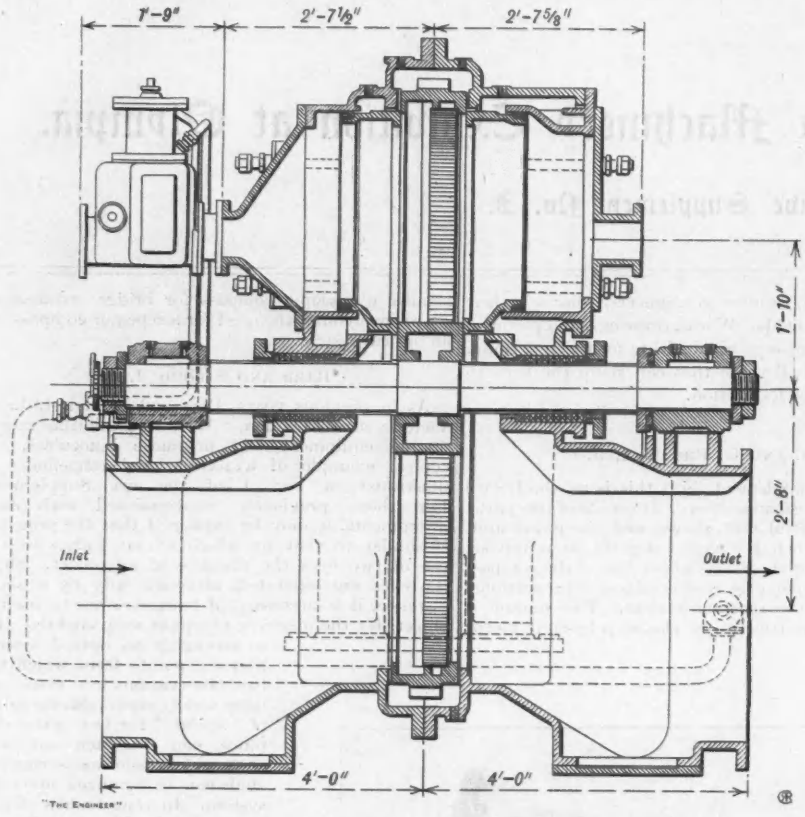


FIG. 2—"BAILEY AND JACKSON" ROTARY STRAINER—HICK, HARGREAVES

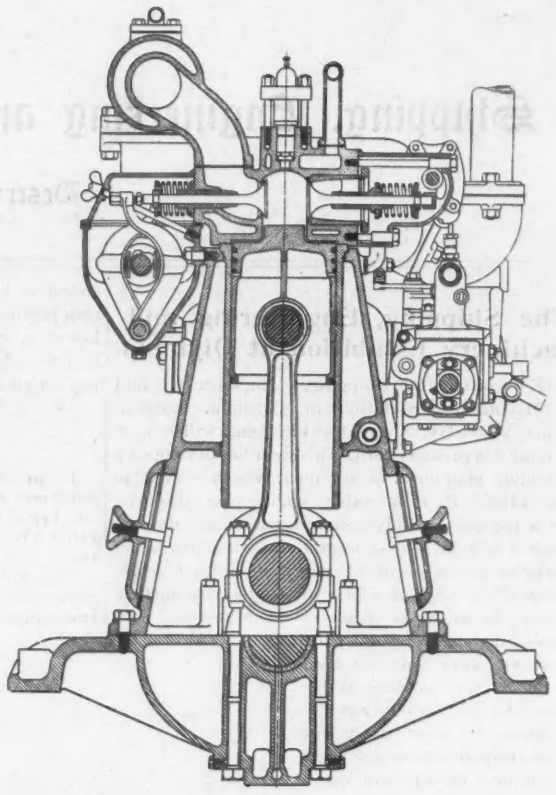


FIG. 4—CROSS SECTION THROUGH OIL ENGINE—GLENIFFER

of condensate per hour against a head of 140ft., and is of vertical-spindle design. The driving motor is mounted immediately above and bolted to the pump. Those conversant with the difficulties inherent in the design of pumping plant of this nature will recognise the characteristically large "eye" of the first stage impeller. The position of this impeller at the lower end of a vertical spindle places it where the largest possible positive suction head can be obtained to drive the water into the blades. The large diameter suction

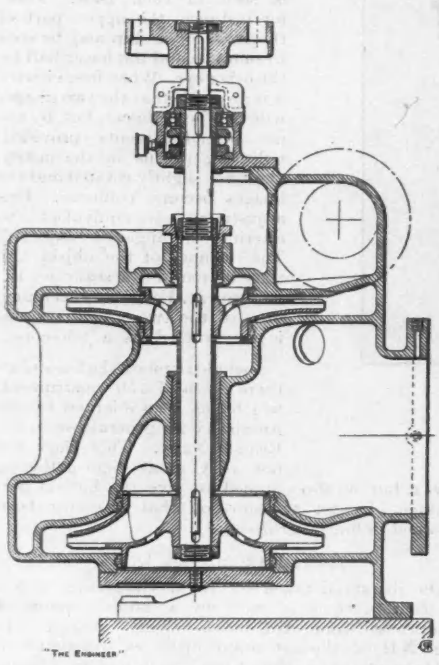


FIG. 3—"HIVAC" EXTRACTION PUMP—HICK, HARGREAVES

branch is provided on the upper side with an air-collecting chamber which, when the pump is installed at the power station, will be vented to the condenser. The second-stage impeller is of normal design, as it receives water at a pressure which prohibits cavitation or air coming out of solution. Both impellers are of the single-entry type, and the end thrust is balanced by the provision of balance chambers in communication with the suction side through holes bored through the impellers. It should also be noticed that the single gland is so placed that

One of the most interesting devices shown on the stand is the "Bailey and Jackson" self-cleaning rotary strainer, illustrated by a line engraving, Fig. 2, on this page, and by Fig. 1. The machine exhibited has branches 22in. diameter and is capable of passing 474,000 gallons of water per hour. Essentially, it consists of a large wheel between the spokes of which there is fitted brass strip to form a mesh of any suitable fineness. This mesh has a depth in the axial direction of 3in. to 4in., with the result that any fibrous material which may collect will not interlace and can therefore easily be removed. By means of worm gearing and a pinion mating with teeth on the periphery of the straining wheel, the latter is driven by belt or in any other suitable manner from an electric motor. Usually, the motor has a speed of 1440 r.p.m. and absorbs about 2 h.p., while the strainer wheel turns at 1 r.p.m. The water to be strained—see the line engraving—passes through the bottom half of the casing, and as the wheel rotates any matter retained in the grid of the strainer is carried round with the wheel. In the upper part of the casing there is an aperture through which a small quantity of water is admitted in a direction opposite to that of the main flow. This cleansing water removes the collected matter from the wheel and can be disposed of in any suitable way. Owing to this efficient cleansing and the wide bore of the branches, the firm claims, the loss of head through the strainer is limited to about 1ft.

Recently there has been fitted to strainers of this type the cam-operated valve, to be seen in the engravings. This valve is only fitted when for any reason the pressure within the casing is above 8 lb. per square inch. Under these conditions the release of the cleansing water causes a difference of pressure between the top and bottom of the casing, and, when the water contains gravel or other solid particles, it is undesirable to attempt to limit the consequent leakage by the provision of fine clearances. The valve is therefore placed on the outlet side of the cleansing circuit, and being normally closed, causes the pressures in the top and bottom of the casing to be equal. It is controlled by a water-power cylinder, the admission of water to which is, in its turn, controlled by a pilot valve driven from a cam plate rotated through gearing from the main shaft of the machine. This mechanism can be seen in the tone engraving. At suitable intervals, usually so arranged as to ensure that each sector of the wheel is cleansed once in every two revolutions, the valve is opened to allow the cleansing water to flow.

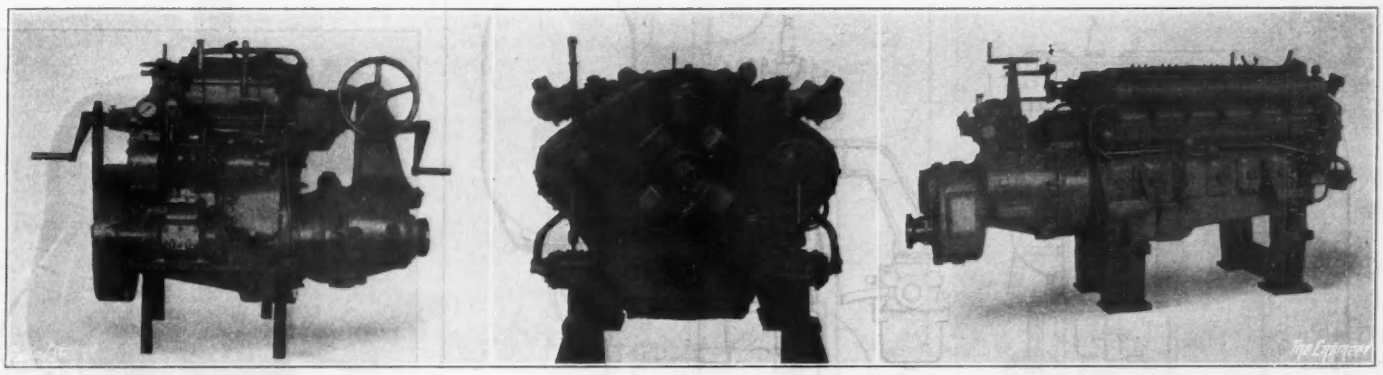
Some rotary air compressors are also to be seen on the stand, and we have chosen for illustration in Fig. XVIII of the art Supplement a two-stage, water-cooled example. This compressor has a capacity of 310 cubic feet of free air per minute compressed to 80 lb. per square inch when running at 960 r.p.m. It

range of sizes which embraces powers of 24 up to 240 b.h.p. in two to twelve-cylinder units. A section through one of the latest type of 4¼in. bore by 6in. stroke engine, which at 1000 r.p.m. is designed to develop 24 up to 96 b.h.p. in two to eight-cylinder units, is reproduced in Fig. 4. This section serves to indicate the simple and robust structure of the engine bed-plate and framing, and the general arrangement of

FIG. 5—MOTOR-DRIVEN EXTRACTION PUMP—HICK, HARGREAVES

the valves and their driving mechanisms, and also the water cooled exhaust manifold. The side view of the engine reproduced in Fig. 6 shows the grouping of the fuel pump, governor, and starting and manœuvring controls. The unit is complete with hand starting gear and with one of the firm's latest standard pattern reverse gears. The largest engine in the range above referred to is the "V" type twelve-cylinder unit, shown in Figs. 7 and 8,

which has a cylinder bore of 6in. and a stroke of 7in. and a designed cylinder output of 20 b.h.p. at 900 r.p.m. It is of interest to record that such items as cylinder liners, pistons, cylinder heads, valves, and pumps are interchangeable throughout the whole range of engines manufactured by the firm and shown at Olympia. We have already described the general construction of the "V" type engine, which, as Figs. 7 and 8 show, is complete with reverse and reduction gears, specially designed for this large unit. It is fitted with the firm's system of single-lever starting. On pulling forward the starting lever the inlet valves are automatically lifted from their seats, and when the starting position is reached the control valve of the four-cylinder air starting motor shown in Fig. 7 is opened. This valve also brings the starting pinion into gear with the toothed fly-wheel rim. Further movement of the starting lever drops the valves on to their seats and places the cylinders on full compression. As the engine begins to gain speed the lever is finally brought into the running position. The complete cycle of operations is accomplished in a few seconds and there is no necessity to bar round the engine into any set position.



FIGS. 6, 7 AND 8—24 B.H.P. MARINE ENGINE AND 240 B.H.P. 12-CYLINDER "V" ENGINE—GLENIFFER

HASLAM FOUNDRY AND ENGINEERING COMPANY, LTD.

Two compressors and a liquid precooler are being shown by the Haslam Foundry and Engineering Company, Ltd., of Derby. The machine shown in Fig. XXII of the art Supplement is a marine-type CO_2 machine, having two double-acting compressors, each 2in. bore by 3½in. stroke. Actually, at the Exhibition, no motor is exhibited, and the compressor has a fly-wheel suitable for coupling to a prime mover or motor. When running at a maximum speed of 400 r.p.m., the machine absorbs about 20 h.p. Forced lubrication is applied to all bearings by a valveless oscillating oil pump situated in the crank case and driven from the tail end of the crankshaft. The crankshaft itself is made from forged high-tensile steel, and is carried in three adjustable main bearings. Open-type crossheads have been adopted. Close-grained cast iron cylinder liners, easily renewable, are fitted. The machine has poppet valves with renewable seats and guides, and these valves are fitted with dashpots to ensure silent running.

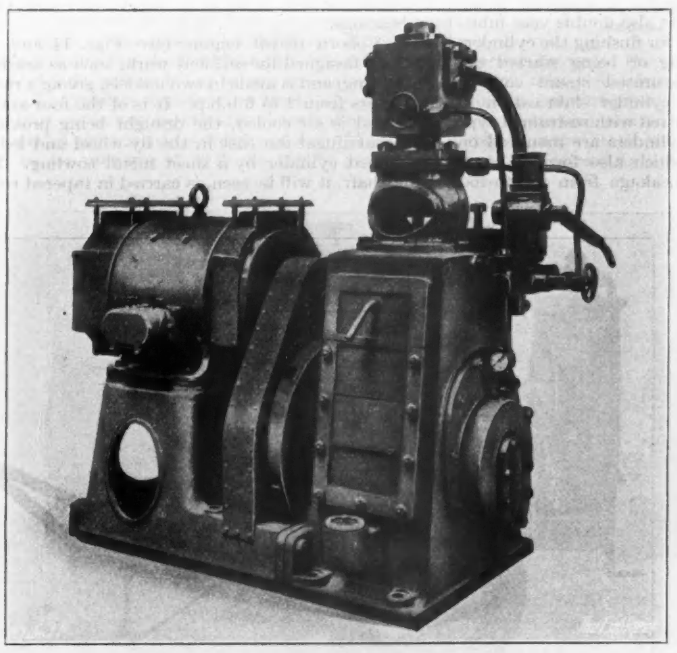


FIG. 9—SINGLE CYLINDER MOTOR-DRIVEN COMPRESSOR—HASLAM

The other compressor, illustrated in Fig. 9, is generally of the same design as that described, but has only a single cylinder, 2 5/16 in. bore by 3½in. stroke, and requires about 10 h.p. when running at 350 r.p.m.

HENRY WIGGIN AND CO., LTD.

It will be remembered that in our issue of June 7th last we described the works of Henry Wiggin and Co., Ltd., at Wiggin-street, Birmingham, on the occasion of the anniversary of the foundation of that firm, and described something of the process of manufacturing nickel alloys. It is not surprising, in view of the centenary, that the company has a rather spectacular display of such alloys at the Fair. The exhibits include specimens designed to show the various uses of Monel metal and nickel alloys that are of interest to ship owners. Two large all-Monel metal laundry washing machines and a laundry pressing machine fitted with Monel metal tables illustrate a use of Monel metal of increasing interest to shipping companies. Some items of galley equipment include tea and coffee-making machines embodying Monel metal containers, and examples of copper-covered pure nickel cooking utensils. The latter are the well-known "Elkington" type used on practically all large passenger liners. Some other minor uses of Monel metal are illustrated by small exhibits. As usual, numerous technical and semi-technical publications describing the properties and uses of the nickel and nickel alloys manufactured by this company are available. These publications are of general interest, for they cover a variety of applications that appear to include almost every sphere of engineering activity.

J. AND E. HALL, LTD.

One of the most interesting exhibits of machinery in the Exhibition is the three-cylinder electrically driven CO_2 refrigerating machine exhibited on the stand of J. and E. Hall, Ltd., of Dartford Ironworks, Kent, which is claimed to be one of the largest machines of its type yet built. It is illustrated in Fig. XXIII of the art Supplement. The compressor is of the single-acting type, with forged steel heads and valve-boxes and spring-loaded suction and delivery valves of the poppet type. The glands are fitted with metallic packing and are oil sealed by a differential pressure lubricator. Attention may be drawn to the clean design of the bedplate and crank case, and the large inspection doors which give easy access to the glands. The machine shown is one of two now on order, which will be installed in a large building in the City of London in connection with the air-conditioning plant. Ammonia compressors are represented by a twin-cylinder high-speed machine, such as is employed for ship and shore work, in connection with provision rooms and cold stores.

There are also shown a number of Hallmark automatic refrigerating plants which usually function with methyl chloride as a refrigerant, but are equally suitable for use with "Freon." In Fig. 10 we illustrate a steam-driven Hallmark plant specially designed for use in trawlers. Many of these machines are now in operation in trawlers operating from Hull and Grimsby. There are three compressor cylinders, each with a bore of 2½in. and a stroke of 2½in., which are directly driven by a double-acting enclosed steam engine running at 500 r.p.m. On the side of the set there is a chain-driven circulating pump. There is an automatic pressure release valve, which will be seen directly above the pump drive casing, and the control valves are arranged at the end of the machine. The set is complete with a submerged type of condenser, the water-cooled copper coils being accommodated within the base plate. The whole plant only weighs about 12 cwt. Similar plants may be supplied in different sizes of engines and compressors.

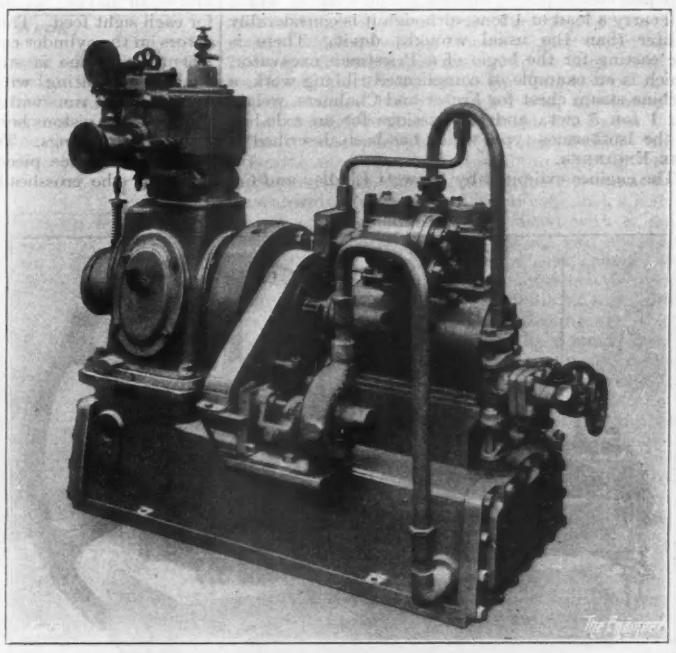


FIG. 10—STEAM-DRIVEN COMPRESSOR SET—HALL

Other Hallmark plants which are shown include electrically driven models for liner and Admiralty work, also small air-cooled compressors, which are used for pantry cooling. All these Hallmark compressors, with the exception of the steam-driven trawler model, are designed for automatic control, and are usually so fitted.

KRYN AND LAHY (1928), LTD. J. BROWETT LINDLEY (1931), LTD.

The two associated firms of Kryn and Lahy (1928), Ltd., and J. Browett Lindley (1931), Ltd., of Letchworth, Herts., are sharing a stand on which there are two distinct classes of exhibits. One of these classes represents the steel castings made by the first

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firm. The merits of these productions were described in THE ENGINEER of April 28th, 1933, when, it may be remembered, we gave an account of some very severe tests to which we subjected specimens. These castings are made from steel refined in Tropenas type furnaces, and are adapted to many types of service from ship's davits and locomotive wheels to component parts of electrical machinery and anvils. The material has the ductility of mild steel with the tensile strength of B.S.S. wearing quality steel, and is easy to machine. The makers, in fact, guarantee that it has a tensile strength of from 35 to 40 tons per square inch, with an elongation of at least 20 per cent. on a standard test piece, and will withstand bending to an angle of 120 deg. without cracking. The specimens exhibited include locomotive, marine, and pressure castings, besides a ship's davit, which will carry a load of 4 tons, although it is considerably lighter than the usual wrought davit. There is the casting for the bogie of a Priestman excavator, which is an example of complicated ribbing work, a turbine steam chest for Fraser and Chalmers, weighing 1 ton 5 cwt., and the castings for an axle-box of the Isothermos type, which has been described in THE ENGINEER.

The engines exhibited by Browett Lindley and Co. include a steam engine, an air compressor, both of which have glass doors on the crank cases and are slowly turned over by a small electric motor to show the motion in action, a horizontal oil engine, and a small petrol set.

The steam engine (see Fig. XIII of the art Supplement) is a 90 b.h.p. compound, with cylinders 8in. and 11in. in diameter by 6in. stroke, and runs at 600 r.p.m. It is intended for a working steam pressure of 180 lb. per square inch and 150 deg. superheat. In these engines the cylinders are cast in one with the valve chest between them. The high-pressure and low-pressure valves are vertically in line, one above the other, and are driven by a single excentric directly below. The cut-off of the high-pressure cylinder can be varied to suit the load on the engine, either by hand or automatically. There is also a centrifugal governor fixed directly on the crank shaft, which operates the throttle valve. The valve is of the double-seated type. The H.P. piston is of cast iron and the L.P. of steel, and both are fitted with special rings of the maker's design. The piston and valve rods have metallic packings. All the motion work, including the governor, is entirely enclosed within the frame and base of the engine, and all working surfaces so enclosed are lubricated by oil under pressure, supplied from a valveless pump placed in an easily accessible position in the lower part of the base, and actuated from the main excentric. The cylinders are lubricated by means of a mechanically driven lubricator having an independently operated pump for each sight feed. There are also double vase lubricators on the cylinder covers for flushing the cylinders when the engine is standing or being started up. Engines operating with saturated steam can be arranged to run without cylinder lubrication if required, the pistons being fitted with restrained type bronze piston rings. The cylinders are mounted on cast iron distance pieces, which also form a bored guide for the crosshead. Leakage from piston-rod glands into the distance pieces is collected and led by means of pipes inside the frame to a small compartment cast inside the engine base. This tank is fitted with a device which automatically separates the oil from the water, the oil returning to the crank chamber, and the water flowing away to a drain.

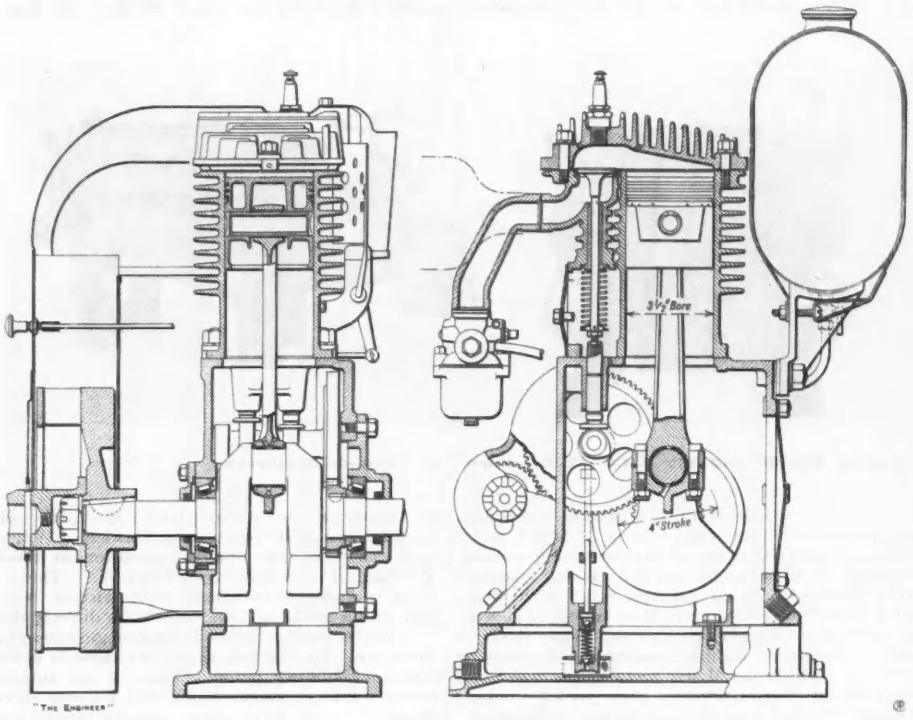


FIG. 11—SECTIONS THROUGH COBORN PETROL ENGINE—BROWETT-LINDLEY

The air compressor exhibited (see Fig. XXI of the art Supplement) is of the same general type as the gas compressors described in THE ENGINEER of April 26th last. It has a capacity of 1000 cubic feet of free air compressed per minute to a pressure of 100 lb. per square inch. It is of the two-stage type, with an intercooler, and has cylinders 19¾in. and 12in. in diameter by 10in. stroke. The control is effected by an automatic unloading valve in the air inlet, and the inlet and delivery valves are of the Hoebiger spring steel plate type, which give a large passageway for a very small lift. The valve chests are arranged behind the cylinders with the ports made as short as possible, in order to minimise clearance spaces, and consequently increase the volumetric efficiency of the machine. The enclosure of the working parts and their lubrication follows the same general principles as those of the steam engine just described.

The oil engine shown in Fig. 12 is of the Campbell cold-starting type for working with heavy crude oil. It is of 12 b.h.p., and has a cylinder 6in. in diameter by 12in. stroke, and runs at 450 r.p.m. The fuel is injected by a pump, having a steel body with a cast iron liner, that makes a full stroke for each injection, while the amount of fuel delivered is regulated on the by-pass principle. The valves are of the ball type and are fitted in removable plugs. The governor is of the spring-loaded centrifugal type, and is driven off the cam shaft by enclosed machine-cut gears. It permits adjustment of the speed by hand, to the extent of 5 per cent., while the engine is running. The crank shaft and cam shaft bearings are ring lubricated, while a pump lubricator with separate adjustable sight feeds supplies the cylinder and crank pin bearings.

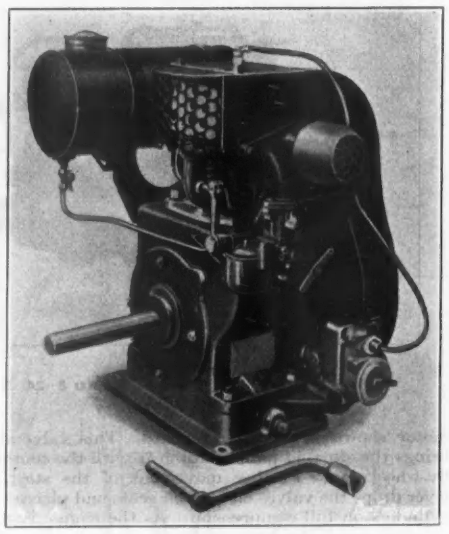


FIG. 13—COBORN AIR-COOLED PETROL ENGINE—BROWETT-LINDLEY

The Coborn petrol engine (see Figs. 11 and 13) has been designed for arduous work, such as outdoor contracting, and is made in two models, giving a range of outputs from 2 to 6 b.h.p. It is of the four-stroke type, and is air cooled, the draught being provided by a centrifugal fan cast in the fly-wheel and led to the ribbed cylinder by a sheet metal cowling. The crank shaft, it will be seen, is carried in tapered roller bearings, and the cam shaft is driven by toothed gears. The engine is governed by a vane in the air stream, which is directly coupled with the throttle and requires no attention. The magneto is of British make, and is driven off the crank shaft by skew gearing. It is equipped with an impulse starter. The carburettor is of the Solex type, with an automatic choke release to ensure easy starting. The tank will hold 1½ gallons of petrol.

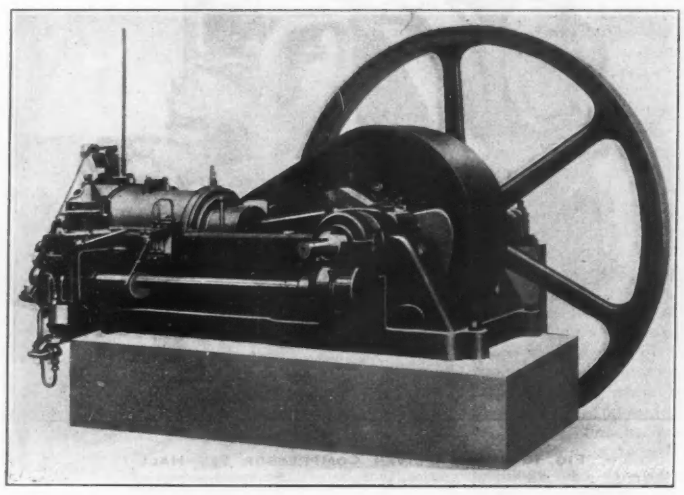


FIG. 12—CAMPBELL COLD-STARTING OIL ENGINE—BROWETT-LINDLEY

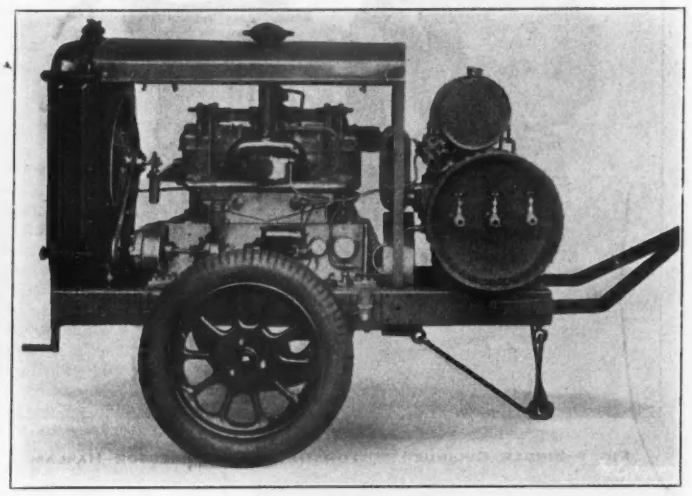


FIG. 14—"SUPALIGHT" PORTABLE COMPRESSOR—BROOM AND WADE

BROOM AND WADE, LTD.

Among the many pneumatic tools exhibited by Broom and Wade, Ltd., of High Wycombe, the squeeze riveter illustrated in Figs. 15 and 17, is of con-

siderable interest. This tool is intended for forming rivet heads by compressive action and for this purpose the pressure is made readily controllable in order to eliminate the risk of loose rivets, over-expanded rivets, or damaged plates. Air is admitted to the tool through a throttle valve controlled by a lever (Fig. 17) or a twist grip (Fig. 15). It acts on the upper side of a piston in the air cylinder and overcomes the resistance of a spring placed below the piston to return it when the air pressure is released. At the further end of the piston rod there is a hardened

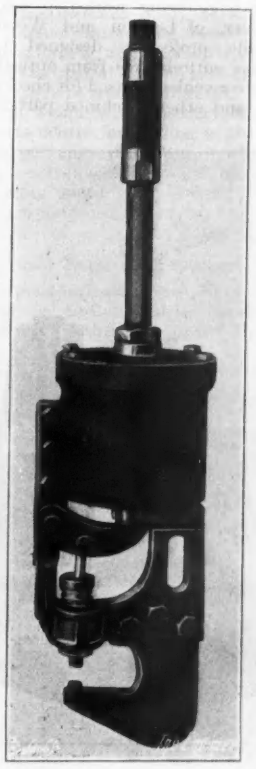


FIG. 15—SQUEEZE RIVETER—BROOM AND WADE

interchangeable end pad bearing upon the end of a cam lever. The latter has a fulcrum on the frame of the tool, and carries a short ball-ended connecting-rod, the outer end of which finds a spherical seating in the ram. Both ram and yoke carry detachable dies or snaps to suit the rivet being closed, and various forms of yoke can be fitted to suit the nature of the work. The makers consider that the tool is especially suited for use in automobile and aircraft shops. With the normal yoke it has a weight of only 12 lb., and with an air pressure of 80 lb. to 100 lb. per square inch, it has a nominal capacity for dealing with $\frac{1}{8}$in. steel, $\frac{5}{32}$in. duralumin, or $\frac{3}{16}$in. aluminium rivets.

Another exhibit on the stand which ought to attract attention is the new portable "Supalight" compressor, illustrated in Fig. 14. This machine is built only in the one size, and has an actual delivered capacity of 60 cubic feet of free air per minute at 100 lb. per square inch pressure, when running at 1200 r.p.m. Lightness and compactness have been achieved by combining the internal combustion engine and the compressor in a single cylinder block, with four cylinders. Numbers one and four cylinders act as compressors and are fitted with mushroom type suction valves and automatic plate type delivery valves. Water in the cooling system is positively circulated by pump, and a gear oil pump force-lubricates the bearings. There is an after-cooler

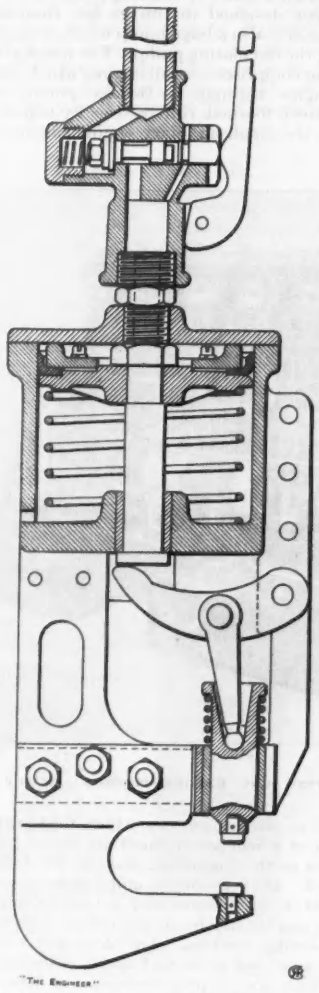


FIG. 17—CONSTRUCTION OF SQUEEZE RIVETER—BROOM AND WADE

inserted between the compressor outlet and the receiver inlet. Automatic unloading gear maintains a nearly constant pressure in the receiver. The compressor plant is mounted on a frame carried on springs from an axle fitted with automobile wheels with pneumatic tires. As the mounting is equipped with over-run drawbar-operated brake gear, the outfit can be towed by a motor car or lorry at high speeds. After detachment from the towing vehicle, one man can easily transport it. As examples of the capacity of the unit, the makers tell us that it will operate a trench pump or a heavy concrete breaker or two rammers or two riveting hammers. In addition to these exhibits the firm is showing a range of single-acting compressors for stationary duty in capacities from 3 to 130 cubic feet of free air per minute, compressed to 100 lb. per square inch. All these machines, from the smallest to the largest, have full forced feed lubrication.

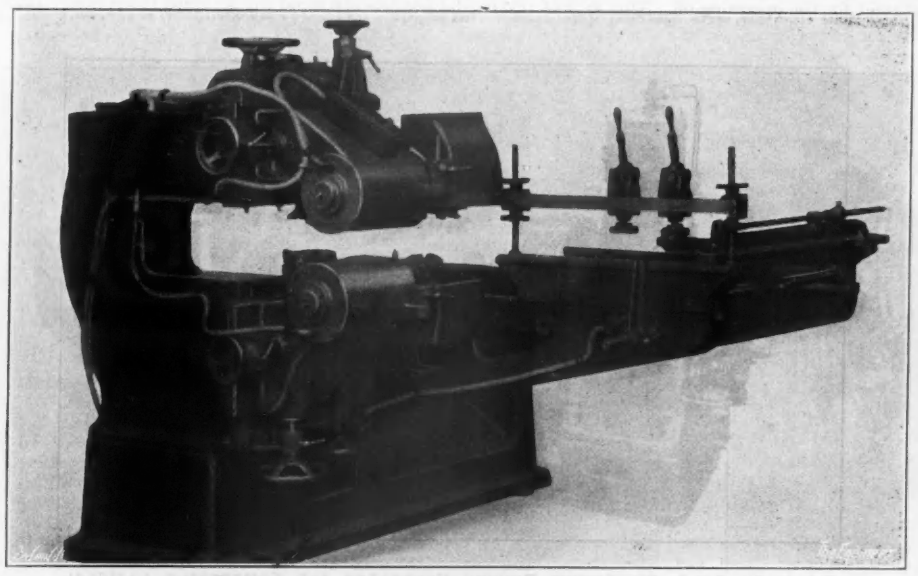


FIG. 16—TENONING AND SCRIBING MACHINE—DOMINION

DOMINION MACHINERY COMPANY, LTD.

There are a number of wood-working machines on the stand of the Dominion Machinery Company, Ltd., Hipperholme, Halifax, England, among which the most novel seems to be the mortising machine illustrated by Fig. 18. It is intended for hollow chisels only, and will take tools up to 1in. square. It is driven by a vertical motor in the head itself, so that

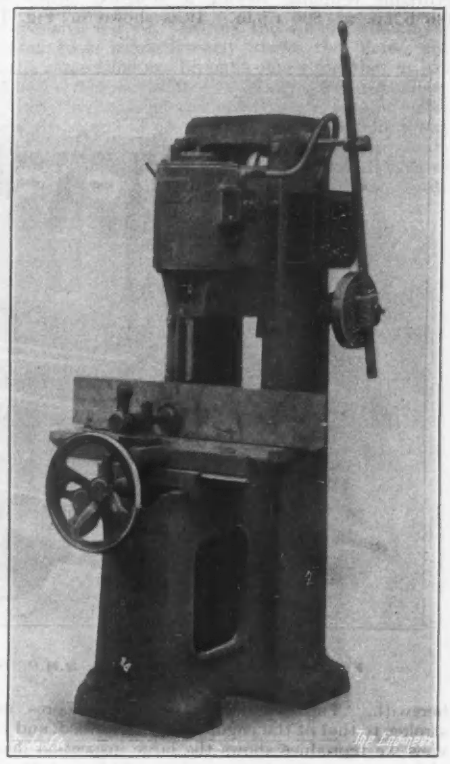


FIG. 18—MORTISING MACHINE—DOMINION

no belts or gearing are required, while a blower mounted directly above the chisel keeps the work clear of chips. There is also a new tenoning and scribing machine (see Fig. 16), which has totally enclosed built-in motors to each cutter head. The capacity embraces timber up to 24in. wide by 6in. thick, and tenons up to 6in. long can be cut at one operation; but the timber can, of course, be passed through so that longer tenons can be cut.

Other machines shown working include Elliot universal machines, which will do ripping, cross-cutting, mitreing, planing, boring, &c. (these machines have already been described in our columns), a heavy-duty vertical spindle moulder fitted with a high-torque, double-wound motor giving two speeds of 3000 and 6000 r.p.m. without a gear change, two hollow chisel chain mortisers, one of which drives the chain directly from the motor spindle, so as to eliminate belts and gearing; and a planing and thicknessing machine which is driven by a single motor. The power is transmitted direct to the cutter block by multiple Vee belts, and to the feed mechanism by flat belt drive to the three-speed gear-box, and from there by Hans Renold steel roller chain, giving three smooth rates of feed. The cutter block is arranged so that moulding irons can be inserted without dismantling the planer irons, and moulding can be done either over the surfacer or through the thicknesser.

An all-electric cross-cutting and trenching machine is on show under power, and here is to be found a machine for cross grain work, such as cross-cutting, mitreing, compound mitreing, stair stringing, tenoning, trenching, grooving, ploughing and boring, &c. It takes up little space as the timber travels the same way for all operations; it can be set to the side of the shop. Dove-tailing machines are manufactured by the Dominion Company in sizes to take timber 12in., 18in. and 24in. wide.

NORRIS, HENTY AND GARDNERS, LTD.

A group of high-speed oil engines designed to cover the requirements of road, rail, and sea transport is to be seen on the stand of Norris, Henty and Gardners, Ltd. (L. Gardner and Son, Ltd., Proprietors), of Barton Hall Engine Works, Patricroft, Manchester. The examples we have chosen for illustration cover the range of applications above mentioned. A large engine is the six-cylinder, 102 b.h.p. marine unit, with power reverse, which we show in Fig. XVII of the art Supplement. It has cylinders with a bore of 4¼in. and a stroke of 6in., and a swept volume of 8·4 litres. The same engine is manufactured in units of three to six cylinders, covering outputs of 51 to 102 b.h.p.

The engine operates on the direct-injection system and the guaranteed fuel consumption is less than 0·370 lb. per b.h.p. hour, with a brake mean effective pressure of about 102 lb. per square inch. The engine is designed for starting from cold, and is complete with a forced water-circulation system. Our engraving shows clearly the neat arrangement of the fuel pumps and governors, and how the controls are assembled at the forward end of the engine.

A good example of the firm's rail traction units is the eight-cylinder engine fitted with a Sinclair hydraulic coupling, having a designed output of 136 b.h.p. at 800 r.p.m. It is shown in Fig. 19 herewith. The cylinders have similar bores and strokes to that of the engine above described, and the view we reproduce shows the large inspection doors giving access to crank case and cam shaft, and also the stiffly designed underbed and oil sump. The chain for the pump drives is totally enclosed, and is arranged at the end of the engine remote from the fly-wheel.

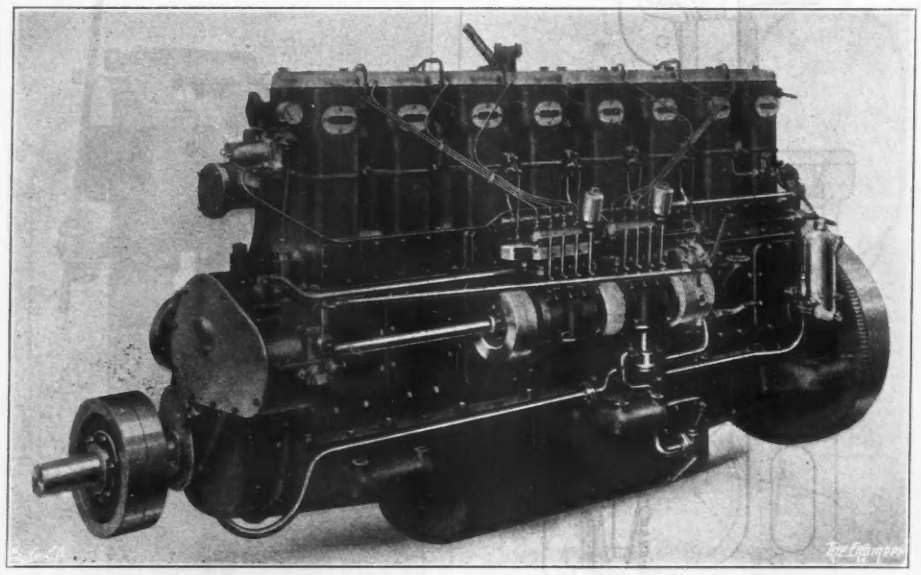


FIG. 19—EIGHT-CYLINDER 136 B.H.P. RAIL TRACTION OIL ENGINE—NORRIS, HENTY

Besides the models we have referred to above the firm is exhibiting a number of marine engines of various outputs coupled with the Gardner patented conic reverse gear. The smallest engine on the stand is the single-cylinder, 9½ b.h.p. unit, running at a designed speed of 1000 r.p.m. and coupled directly on a common bed-plate to a 5-kW generator. A view of the lighting set, which has been specially designed for ship service, is reproduced in Fig. 20 herewith.

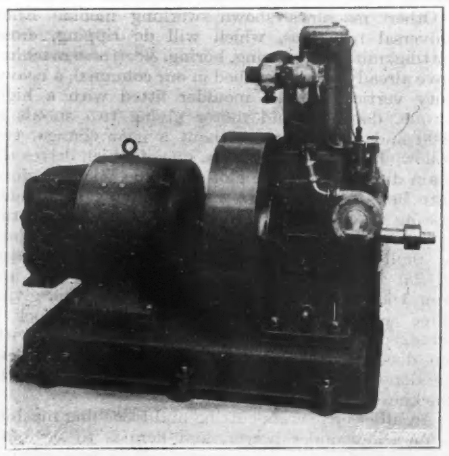


FIG. 20—5-KW SHIP'S LIGHTING SET—NORRIS, HENTY

NATIONAL GAS AND OIL ENGINE COMPANY, LTD.

All the larger engines which are exhibited on the stand of the National Gas and Oil Engine Company, Ltd., of Ashton-under-Lyne, are of the vertical four-stroke airless injection type, arranged for starting from cold. They have been specially designed to cover a wide range of uses, including industrial and generator drives, and also marine propulsion and auxiliary work. Among the principal features may be mentioned the complete enclosure of all working parts, a patented design of cylinder head, facilitating cold starting without special ignition or preheating devices, non-choking atomisers, and valves which can be quickly removed for examination without the necessity of breaking cylinder head and pipe joints.

We illustrate in the art Supplement—Fig. XV—the largest exhibit on the stand, which is a six-cylinder marine engine complete with National oil operated reverse reduction gear. This unit has a designed output of 240 b.h.p. at 600 r.p.m., and the cylinders have a bore of 8in. with a stroke of 12in. The engine is equipped with direct-driven pumps, which include a water circulating pump of the reciprocating type designed to run at less than one-third engine speed; also a bilge pump which is interchangeable with the circulating pump. The standard method of starting comprises a small engine, which rotates the main engine through a Bendix pinion engaging with a steel toothed rim on the fly-wheel. Alternatively, the small auxiliary engine can be arranged to drive an air compressor which feeds through the medium of a receiver a small air motor mounted as indicated in the engraving, directly above the engine fly-wheel. Both the main and auxiliary engines are equipped with compression release gears so that starting can be effected immediately without the use of preheating devices. The National oil operated reverse gear has a normal speed reduction ratio of 2 : 1, which gives a propeller speed of 300 r.p.m. An interesting feature of the gear-box is the use of clutches, which consist of a series of conical concentric rings and grooves which are brought into frictional contact by oil pressure. The operating oil is delivered to the control valve, which directs it to the "ahead," or "astern" position or the "neutral" position for idling. Our illustration Fig. XV serves to indicate the compact nature of the gear. It is carried in a strong base-plate bolted directly to the engine bed-plate, and is complete with its oil pumps and a reservoir for the operating oil. This type of reverse-reduction gear is achieving considerable success, we are informed, on account of its small size and the ease with which it may be manipulated.

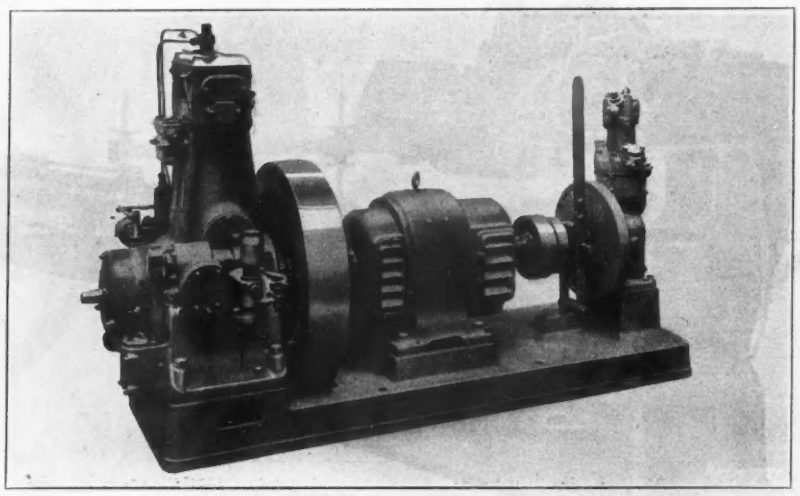


FIG. 21—9¼ B.H.P. OIL ENGINE DRIVING GENERATOR AND COMPRESSOR—NATIONAL

Another unit which we do not illustrate consists of a typical marine set of the four-cylinder type, with cylinders having a bore of 4½in. and a stroke of 6in., designed for an output of 37 b.h.p. at 1000 r.p.m. The features of this set, which is fitted with a hand starting equipment, are generally similar to those above described, but the gear-box is of the bevel wheel epicyclic type. An engine with similar cylinder sizes is the 9¼ b.h.p. unit, shown in Fig. 21, which drives a generator and an air compressor at 1000 r.p.m. The three units are mounted on a single bed-plate and are so arranged that the air compressor can be brought into operation as and when desired. The firm is also exhibiting a 5 b.h.p., 600 r.p.m., single-cylinder engine having a bore of 3¾in. and a stroke of 5½in., which has a monoblock crank case and splash lubrication and has been specially designed for industrial drives of comparatively small horse-power.

ERNST LEITZ.

A wide range of scientific instruments, specially designed for engineering workshop use, is shown by Ernst Leitz, of London and Wetzlar. These include profile projectors designed to give an accurate image entirely free from optical distortion, which can be conveniently used for checking threads, gear wheels, and other machined parts. A feature of the latest design of instrument is the arrangement whereby the real image of the standard is superimposed on the test piece and both are projected together by the same optical system.

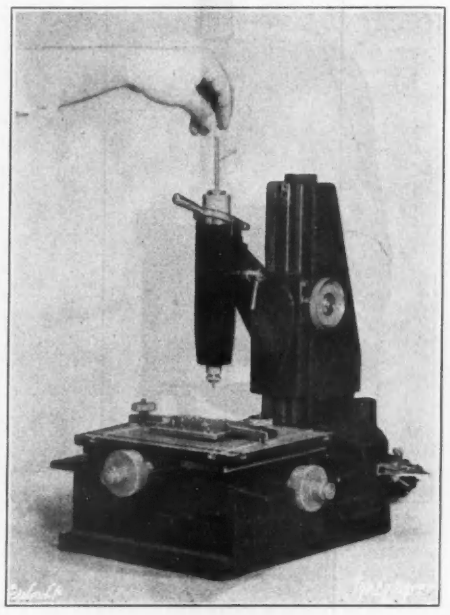


FIG. 22—TOOLMAKERS' MICROSCOPE—LEITZ

For metallurgical investigation the firm is showing, along with its large metallographic microscope, the special Ultropak illuminator for the convenient examination of large metal surfaces, and such irregular shaped parts as cannot be examined with a standard metallurgical instrument. Another special microscope of interest to engineers is the Panphot reflex photo-micrographic outfit, which marks a new departure from practice hitherto followed, in that it permits of a rapid change being made from ordinary incident to polarised incident or transmitted light. The image from the microscope passes straight through on to the photographic plate without the distortion which might be set up by an intermediate reflecting surface. In this instrument a permanently built-in source of light is used, so that whatever type of illuminator is required, the necessary adjustments are reduced to a minimum.

We illustrate in the art Supplement, Fig. III, and in Fig. 22 herewith, a new tool-makers' microscope which is being shown for the first time in this country. Outstanding features of this instrument,

which are shown in our engravings, include the robust design of base, table, and slide. When fitted with the standard template tube, any combination of templates may be used. These take the form of ruled glass plates with standard angles and thread forms, &c. In this microscope, too, the images of the template and that of the part being viewed are produced together by the use of special optical systems, which prevent distortion. The microscope may be fitted with a double image tube designed to measure the exact distance between holes in jigs, &c. The distance is measured by adjusting the horizontal slide to make two separated images coalesce, the slide reading then giving the exact distance apart of the two holes sighted. A further interesting attachment is the jig spotting spindle (Fig, 22), in which the centre pop is carried within the optical system, enabling absolutely accurate centring to be readily obtained. By dropping a central sliding weight when the microscope has been set, an accurate centre for drilling is given. As will be seen from our engravings, the mechanical stage or table may be displaced in two directions and the microscope tube raised and lowered. The table adjustments are made to record to one-thousandth of an inch.

BIRMINGHAM ELECTRIC FURNACES, LTD.

Perhaps the most interesting exhibit of Birmingham Electric Furnaces, Ltd., of Birlec Works, Tyburn-road, Erdington, Birmingham, is the Birlec-Detroit

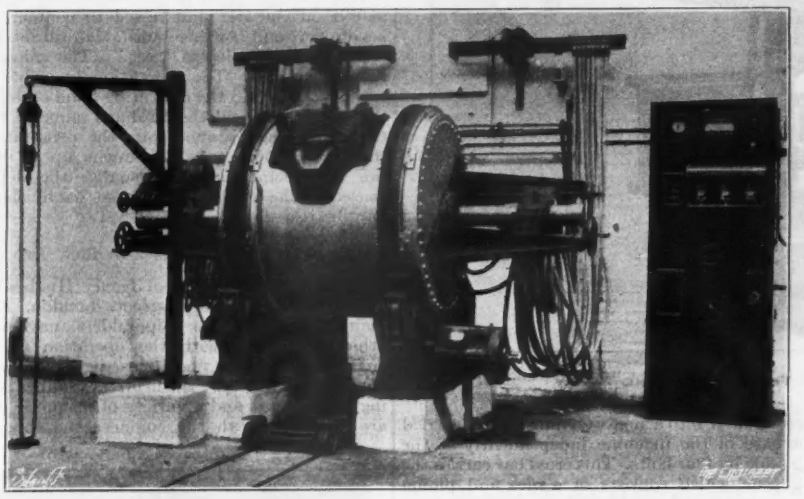


FIG. 23—BIRLEC-DETROIT ROCKING ARC MELTING FURNACE—BIRMINGHAM ELECTRIC

rocking arc melting furnace for ferrous and non-ferrous metals. Among the claims made for it are flexibility, exceptionally rapid melting, remarkably close control of analysis, temperature, &c., unusually low melting losses, and the production of metal of perfect homogeneity and excellent physical properties. As shown in Fig. 23, the furnace has a horizontal cylindrical melting chamber, and on the axis a single-phase arc is established between two graphite electrodes. During the melting period the chamber is continually oscillated about its axis and thus stirs the bath of metal and ensures its intimate contact with all parts of the heated lining, thereby providing an exceptionally high melting speed.

As the chamber is effectively closed during melting, the melting losses are limited to a very small amount. Both the radiation losses and consumption of electrodes are reduced to a minimum. A single unit of this type, having an easily cleaned melting chamber of simple shape, may be used for a wide range of metals and alloys without alteration. The charge may be made up largely or entirely of cheap scrap materials, such as turnings, borings, &c., and high-quality metal can therefore be produced at very low cost. In the ferrous foundry the high degree of superheat control obtainable is claimed to be extremely useful, while in non-ferrous work the exceptionally low metal loss and the assurance of uniform composition throughout the melt are equally important features. The furnace is made in a wide range of types and sizes to suit every requirement, and several examples are in successful use in this country in both ferrous and non-ferrous foundries.

TURBINE GEARS, LTD.

Among the machine tools shown at Olympia the gear cutters exhibited by Turbine Gears, Ltd., of Cheadle Heath, near Stockport, are particularly interesting. The three machines shown in operation are respectively an automatic bevel gear generator of the Robey-Smith type, and an automatic spiral bevel gear generator and a 20in. automatic worm wheel generator, both of the Smith and Coventry type. These classes of machine are now being manufactured at the Cheadle Heath works, and although based upon the Smith and Coventry designs, they have been subjected to numerous improvements.

In the bevel gear generator the principle of operating the cutting tools is that of the shaping machine. Two tools are used operating on the two sides of a single tooth. Their lines of motion, of course, converge towards a centre intersecting the apex of the wheel to be cut, and means are provided, as can be seen in the engraving, Fig. 24, for adjusting the angle between them. After each stroke of the tools the gear blank is rotated through the angle of one pitch, so that any error that may possibly arise through tool wear is distributed over the whole wheel. Those conversant with the geometry of tools of this nature will recognise from the engraving that the work-holding and dividing head is arranged to have an angular motion about a centre which lies on the apex of the blank. By this means the work can be fed into the tools. An automatic stop is fitted which comes into action when the correct depth of tooth has been obtained. The correct curve of the tooth is formed by the mechanism for opening and closing the pivoted tool-carrying arms. The saddle carrying the work is connected to the pivoted arms carrying the slides and cutting tools by a curved bar, having teeth cut in a portion of its circumference; these teeth engage with a quadrant which, through a pair of bevel wheels and slotted lever operating through a connecting-rod, controls the swinging parallel motion, which, in turn, controls the pivoted arms. The machine is electrically driven by a constant-speed motor.

The second engraving, Fig. 25, beside the first, shows a spiral bevel gear generator, and the points of similarity of the two machines are at once obvious. This machine is designed to produce gears with the correct spiral form with tools of a very simple and inexpensive nature. During the cutting stroke the cutting tools move linearly across the blank, and at the same time are brought closer together in just the same manner as in the straight bevel machine. To suit the angle of the spiral being cut, however, they are mounted on the tool heads in such a way that they can be angularly adjusted. The necessary angular movement of the wheel blank is geared definitely to the linear motion of the tool heads.

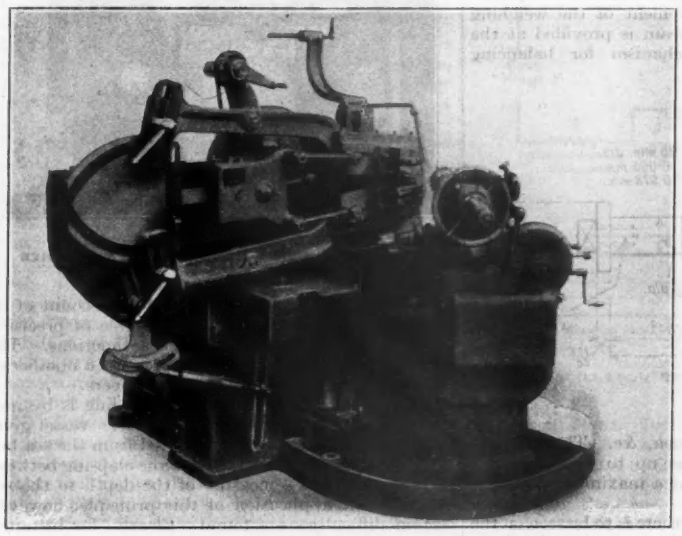


FIG. 24—STRAIGHT BEVEL GEAR GENERATOR—TURBINE GEARS

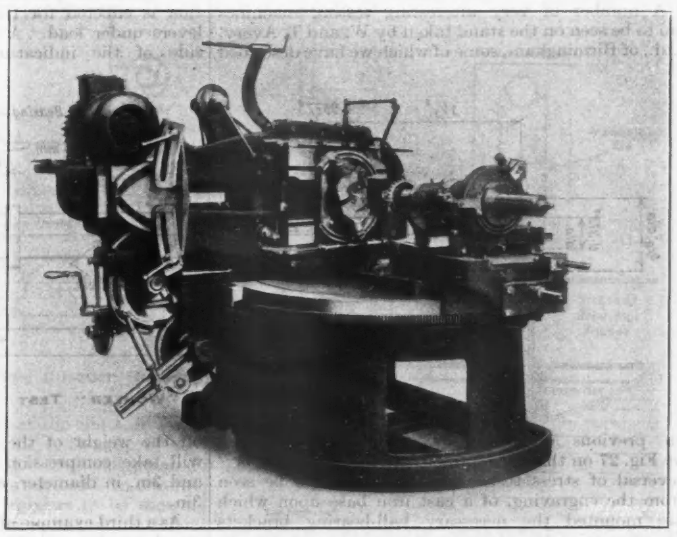


FIG. 25—SPIRAL BEVEL GEAR GENERATOR—TURBINE GEARS

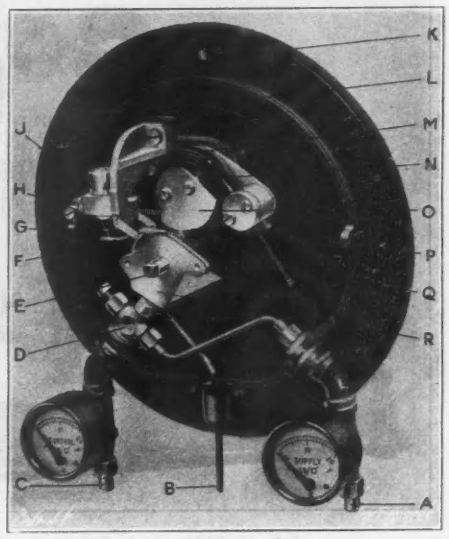


FIG. 26—TEMPERATURE CONTROLLER—NEGRETTI

During the return stroke of the tools the blank remains stationary and the movements are so interconnected that the tools again enter the blank at the correct spacing from their previous point of entry. Two of the advantages claimed for this machine are that the spirals cannot disagree, being dependent on the gearing as in screw-cutting, and that the gear blank is set in position just as simply as for straight bevels.

NEGRETTI AND ZAMBRA.

The firm of Negretti and Zambra, of 38, Holborn Viaduct, London, E.C.1, has always much of interest on its stand. On this occasion, we have chosen to illustrate in Figs. 26 herewith and in VI(of the art Supplement a non-indicating temperature controller and a dial thermostat. The operation of the first-named instrument is as follows. The Bourdon tube M—a flattened coiled tube—is the moving part of a mercury-in-steel thermal system. As the mercury in the sensitive bulb expands and contracts with temperature changes in the plant, the change of volume is communicated through the capillary tube B to the Bourdon tube M, causing the latter to coil and uncoil slightly. The cam plate O moves with the Bourdon tube, and when the small

step on this plate passes a roller on lever F, this lever is tilted slightly and through a tappet G operates an air leak valve J. Owing to the restriction of the inlet air at D, small changes of opening of the air leak valve J result in large changes of pressure in the control line C. This control line may be connected to diaphragm-operated valves or other gear, depending on requirements. An alteration of the point of control is effected by moving the Bourdon tube and cam plate bodily on their axis. All backlash is taken up by a spring, and the setting spindle E is provided with a friction device to prevent any alteration of the setting point as a result of vibration. The Bourdon stem Q contains a compensating arrangement which ensures that changes of temperature of the Bourdon itself do not affect its movement.

The dial thermostat—Fig. VI—is interesting because Negretti and Zambra have designed a series of such indicating instruments in which the arrangement of the electrical contact gear was made a primary consideration. In automatic control work the contacts may be required to operate every few minutes possibly for twenty-four hours a day, and their design for lasting quality therefore presents important problems. The switch mechanism of the firm's instruments is designed in three alternative manners. Open platinum contacts give the very closest control, but generally necessitate the use of relays. The mercury tube switch type can safely handle up to 1 ampère at 250 volts, but gives a differential of about 3 per cent. of the scale range. Lastly, there is another form of mercury tube switch type which is used chiefly for alarms and safety cut-outs.

W. and T. Avery, Ltd.

A number of very interesting testing machines are to be seen on the stand taken by W. and T. Avery, Ltd., of Birmingham, some of which we have described on previous occasions. The machine illustrated by Fig. 27 on this page is to be used for the "Wohler" reversal of stress test. It consists, as will be seen from the engraving, of a cast iron base upon which are mounted the necessary ball-bearing brackets for supporting the specimen, a motor for rotating it, and a counting gear for recording the number of reversals. If an A.C. motor is fitted it runs at 2000 r.p.m., a D.C. machine being capable also of 1000 r.p.m. We need not describe in full detail all the arrangements for carrying the specimen. The shackle which connects the specimen to the steelyard is machined to receive a trunnion which is provided to allow free movement of the specimen arising from deflection while permitting the connecting-rod to give a vertical pull to the steelyard. When the specimen fails the falling of the steelyard cuts out the motor through the medium of a trip switch. The steelyard is graduated to 150 lb. by divisions of 1 lb., and the poise is propelled by a handwheel through gearing and a screw. It will be observed by reference to the engraving that there is a pointer arm arranged above the steelyard. It indicates the amount of the deflection of the specimen in units of 0·0002in., and is particularly useful as defining the limit of proportionality. Details of the type of specimen used are given in Fig. 28.

Another testing machine shown by the firm is illustrated in Fig. VII of the art Supplement. It is especially designed for testing springs in compression with quickness and accuracy, but can also be used for tension springs. In essentials it consists of a weighing machine reading to 150 lb. in 8 oz. divisions, with a suitable apparatus for holding the springs mounted on it. A central cross bar is mounted on two tubular supports which are screwed into a non-weighing platen carried from the base of the machine independently of the weighing scale by four bolts. This cross bar carries the straining gear, which consists of a rack and pinion mechanism operated by a hand lever and so spring loaded that on the release of pressure it returns the loading platen to the upper position. The spring to be tested is inserted beneath the loading platen and between it and the platen connected to the weighing mechanism. The upper end of the rack bar is adapted for the testing of springs in tension, pulling down the specimen hanging from the upper cross bar, which is supported by rods carried from the weighing mechanism. The rack bar at its upper end also carries a pointer reading against a scale on the supports for the upper cross bar and giving a reading of the deflection of the spring. By placing the scale in this position, it will be realised, compensation is effected for the movement of the weighing levers under load. A tare beam is provided at the side of the indicating mechanism for balancing off the weight of the specimen, &c. The machine will take compression springs up to 8in. in length and 3in. in diameter, and has a maximum stroke of 3in.

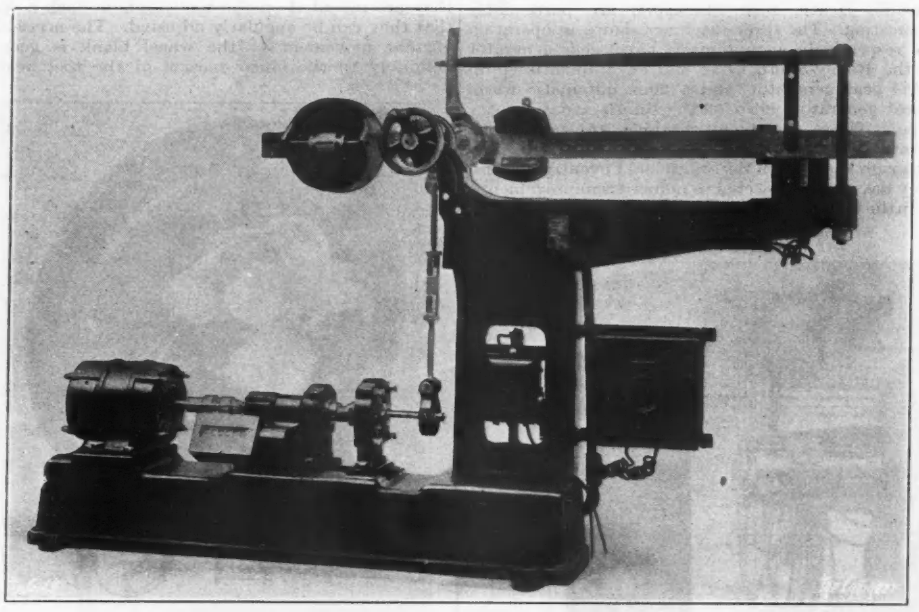


Fig. 27—"Wohler" Reversal of Stress Testing Machine—Avery

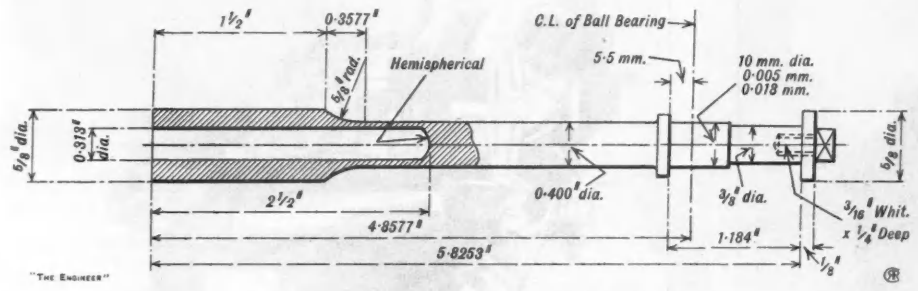


Fig. 28—Specimen for "Wohler" Test

As a third example of what there is to be seen on the stand, we have chosen the direct reading hardness tester illustrated in Fig. II of the art Supplement. This machine has been specially designed for rapidly determining the hardness of materials in terms of standard "D.R." penetration numerals. These numerals are based on the depth of impression produced by standard penetrators under the action of standard major loads. In order to eliminate errors arising from imperfections of the surface of the specimens, the measured impressions are superimposed on those produced by a standard minor load. The machine consists principally of a standard carrying an adjustable table, a penetrator with loading device, a depth-measuring gauge, a weight-lifting and releasing mechanism, and a loading speed controller.

Two standard forms of penetrator are used, one being a steel ball of $\frac{1}{16}$in. diameter, and the other a diamond cone of 120 deg. face angle terminating in a spherical end. Both major and minor loads are imposed by means of weights acting through a sensitive weighing lever. The standard minor load is 10 kilos., and is applied automatically when the specimen is set up. Two standard major loads are used, 100 kilos. for use with the $\frac{1}{16}$in. steel ball penetrator, and 150 kilos. for use with the diamond cone penetrator. The depth-measuring gauge is an accurate dial instrument, which gives direct readings in terms of the two standard penetration scales applying to the $\frac{1}{16}$in. diameter ball penetrator, and 100 kilos. load and to the diamond cone and 150 kilos. load respectively. The proportional weights are raised by means of a lever and link motion operated by means of a handle situated at the side of the standard. When the weights are in their raised position the handle is held by means of a simple catch lever, which it is necessary to release in order to apply the load. A plunger is attached to the weight-lifting table, and is depressed when the load is being applied. This plunger works in an hydraulic cylinder, and the fluid which is displaced passes through a valve to the container. Fine speed control is obtained by the regulation of this valve. An additional valve is provided to enable the fluid to flow into the cylinder when the weights are raised.

When a test is to be conducted the specimen is placed on the rest and raised to contact with the penetrator and further until the subsidiary hand of the gauge indicates "set." The minor load is thereby applied. The proportional weights are then applied, and when the indicating hand ceases to move they are raised and the hardness numeral read from the dial. The distance from the penetrator to the standard is 5½in., and specimens up to 8in. thick can be accommodated. Usually, the deformation caused by the test is negligible, so that finished articles may be tested.

Henry Hughes and Son, Ltd.

Although the exhibits of Henry Hughes and Son, Ltd., of 59, Fenchurch-street, London, E.C.3, are mainly of interest to shipbuilders, navigators, and others concerned with the operation of shipping, engineers may well find it instructive to pay a visit to the stand taken by the firm. A number of navigating instruments and a variety of magnetic compasses are shown, but to the engineer the echo-sounding

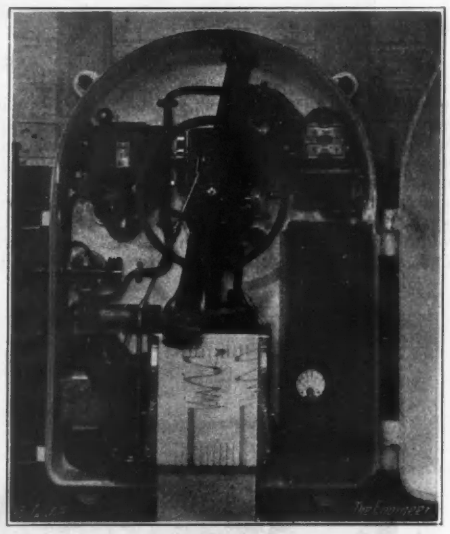


Fig. 29—"Husun" Echo Sounder—Hughes

equipment is likely to appeal most on account of its ingenious mechanism and of the degree of precision with which it has to perform its functions. The electrical side of the device also presents a number of problems intriguing to electrical engineers.

The general principle of echo sounding is by now well known. A suitable emitter on the vessel gives out a sound and the sound reflected from the sea bed is picked up by a receiver. The time elapsing between the two events is a measure of the depth to the sea bed. In the application of this principle, however, certain difficulties are found. Clearly, for instance, account must be taken of the possibility that noises produced by the motion of the ship and the rotation of the propeller may "blanket" the reception of the reflected sound waves. Moreover, a very extreme accuracy is required in the measurement of the time interval, since the speed of sound in water is, very approximately, 4900ft. per second. Precision of the order obtained with a stop watch would lead to inaccuracies as great as 200ft. or more.

Various methods of emitting sounds are available for use in echo sounding. In the Husun instrument use is made of the property of magnetostriction. Certain materials possess this property of changing

their linear dimensions when subjected to a magnetic field, and, conversely, of changing their magnetic condition when mechanically strained. Of these materials nickel has been found the most suitable for use in the oscillators required for depth sounding. Those interested in the construction of oscillators with suitable characteristics may be referred to a paper entitled "A Magnetostriction Echo Depth Recorder," read before the Wireless Section of the Institution of Electrical Engineers on January 2nd

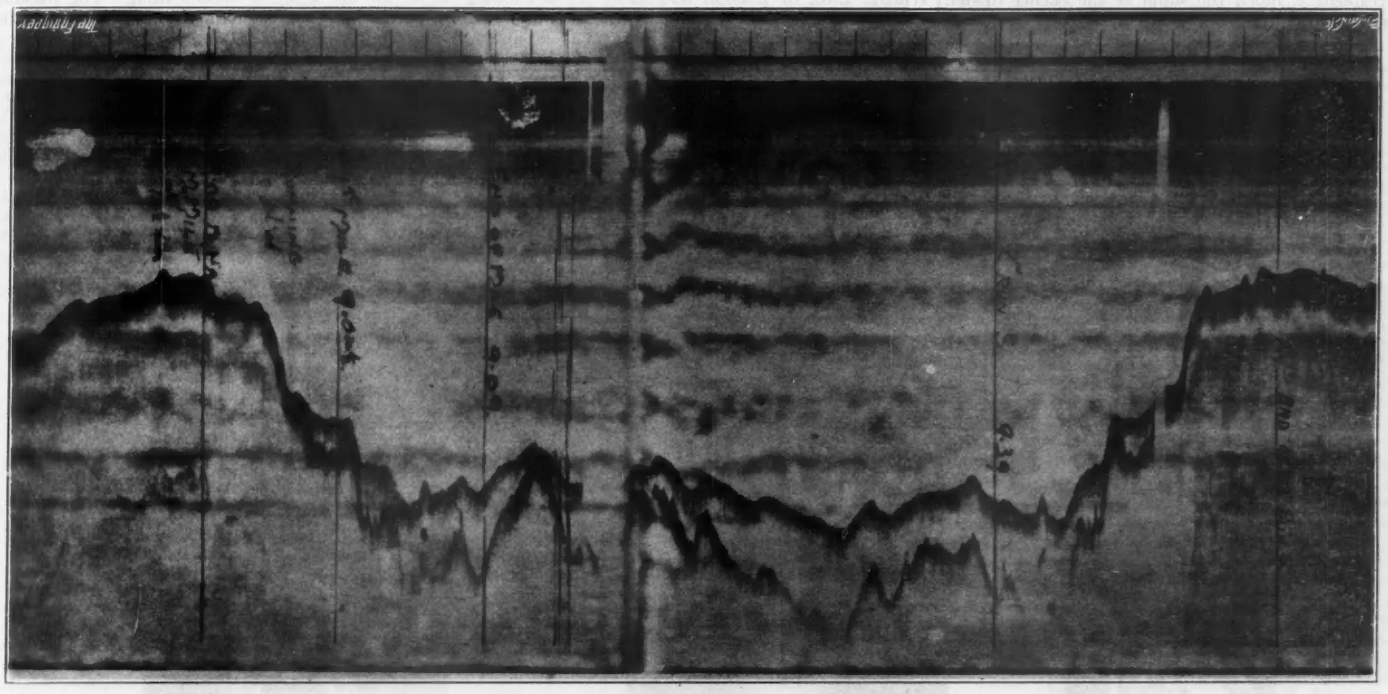


FIG. 30—PROFILE OF SEA BOTTOM AS RECORDED BY "HUSUN" ECHO-SOUNDER—HUGHES

of this year. Considerations of space forbid us attempting a description here. A typical circuit for the excitation of the oscillator is given in Fig. 31. A condenser C is charged through a current-limiting resistance R from a supply voltage V, the key K being in position 1. At a predetermined time the key is switched over to position 2, and the condenser discharges through the low-resistance winding of the magnetostriction device, which is thereby caused to oscillate at high frequency. The short train of waves emitted is reflected from the sea bottom into a receiver of identical construction to the emitter with the exception that it is initially magnetised so as to give out current impulses when "oscillated" by the sound waves. It is arranged to have the same natural frequency as the emitter. The small electromotive forces so developed are amplified by means of a step-up transformer with a tuned secondary winding, and the output from the tuned circuit is applied to the first valve of an amplifier which feeds the recording device. The system is arranged to emit "sound" at a frequency beyond the audible range, and both the emitting and receiving circuits being tuned to a certain narrow band of frequencies, extraneous disturbances introduced by the passage of the ship through the water have little or no effect upon the instrument.

In practice the emitter and receiver are mounted close together at the bottom of the ship in separate water-filled tanks. There is no need to pierce the ship's bottom. Many refinements are introduced to modify the inherent directional emitting and receiving properties of the magnetostriction devices and those interested may be referred to the technical paper already mentioned. All the remaining apparatus, including the recorder, is contained in a metal case, which can be placed, for instance, on the bridge of the ship or in any other convenient position. A diagrammatic representation of the complete apparatus is reproduced in Fig. 32.

A record of the profile of the sea bed is made upon a roll of chemically sensitised paper which travels at a slow rate beneath a stylus point. This stylus is traversed rapidly back and forth across the paper by the well-known device of a spiral groove in a rotating roller. In one direction of traverse the stylus is in contact with the paper, and on the return stroke it is lifted off it by a cam. The stylus-driving mechanism, which is driven by an electric motor fitted with a governor to maintain constant speed within very close limits of accuracy, constitutes the means for measuring the time interval between the emission of the "sound" waves and their reception after reflection from the sea bottom. The stylus travels at a constant speed across the paper chart. At or near the beginning of its traverse a switch is closed and reopened to energise the transmitter and at the same instant a pulse of current is caused to pass from the stylus point through the chemically prepared paper to the metallic support of the latter, thereby causing the paper to be stained. After a short interval the reflected sound is received. By this time the stylus has travelled some distance across the paper, and another pulse of current being sent through it the paper is again stained. Since the motion of the stylus is carried out at constant speed it is clear that the interval between the two stains on the paper chart is directly proportional to the depth to the sea bottom. The cycle of operations continues at such short intervals that the stains on the paper form continuous lines, as shown in Fig. 30.

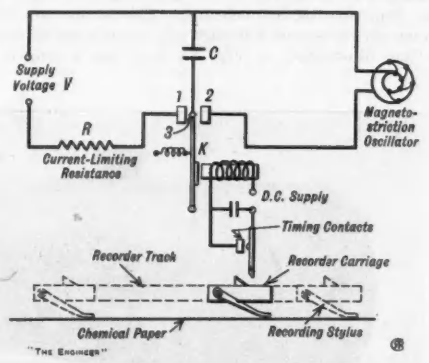


FIG. 31—OSCILLATOR EXCITATION CIRCUIT—HUGHES

sea bottom alone. In one part of the chart, in fact, a shoal of fish has been "caught." The top of the heaviest wavy line is a reproduction to an exaggerated vertical scale of the profile of the sea bed. In several places more than one bottom appears to be shown. This effect arises from the presence of mud or other soft material overlying rock, with the result that an echo is received from each surface. Where the bottom is clean, hard rock, a secondary echo may be received, but can be recognised because the depths recorded bear a constant relation (usual 2 : 1) to the real depth at all points. The record, therefore, besides giving the actual soundings, is also able to provide interesting and useful information as to the character of the sea bed. Moreover, owing to the exaggeration of the vertical scale, the instrument draws an easily recognisable profile. The record reproduced was obtained in two traverses of a ship across a measured mile, one in one direction, and one in the other, and the almost "looking glass" identity of the profile on the two traverses which are marked by vertical lines at each end, is very striking and demonstrates how valuable this property may be to a navigator. The vertical lines mentioned are obtained by pressing a key on the instrument, and are used for "fixing" soundings—that is, bearings are taken from the ship of suitable fixed points at the moment the key is depressed and these cross bearings "fix" the actual position of that particular sounding. This feature is of practical importance in marine surveying, of course. Immediately between the two mile runs it may be noticed that there is a part of the chart on which no soundings are recorded. At this point the ship was circling and water containing a large number of air bubbles was drawn under the vessel and temporarily "blanketted" the sound waves.

For all the ordinary purposes of navigation this instrument, which can be adapted to sound for various ranges of depth, is entirely suitable. But in very shallow water it has certain disadvantages. Under such conditions a higher degree of accuracy is required so that each foot of depth occupies a wider spacing on the chart. In effect, this desideratum requires that the stylus shall travel more rapidly across the chart. In the original of the chart reproduced $\frac{1}{8}$in. represents a fathom—that is, the stylus travelled $\frac{1}{8}$in. while the sound travelled 2 fathoms (1 fathom towards the bottom and one fathom on the return). Calculation will show that the rate of traverse of the stylus must be about 45in. per minute. If, as is necessary for shallow water, each $\frac{1}{8}$in. on the chart represents

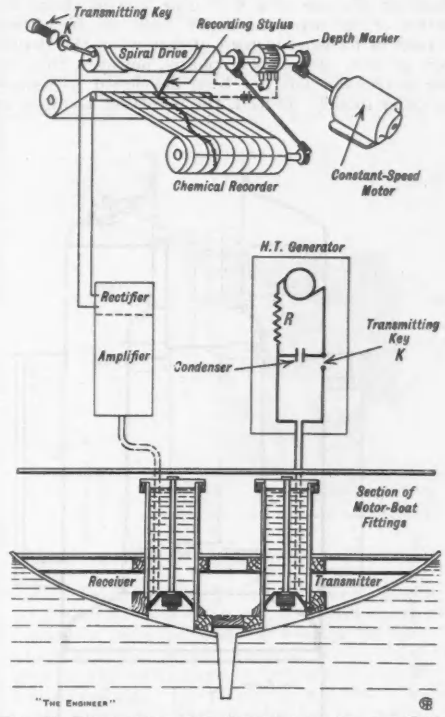


FIG. 32—DIAGRAMMATIC ARRANGEMENT OF ECHO SOUNDING APPARATUS

1ft., the stylus must travel six times as fast, and under such conditions the type of mechanism adopted is liable to strain itself, and, therefore, to suffer inaccuracy. To meet this condition the apparatus shown in Fig. 29 has been developed recently. In place of the "straight line" motion of the earlier type a rotary motion of the stylus is adopted. The stylus is, in fact, mounted on an arm which carries at its other end the contacts for making and breaking the circuits to the "sound" emitter, and which is capable of rapid rotation. In other respects the new instrument is much the same as the earlier model. Very accurate representations of the bed profile at shallow depths can be obtained with this instrument, while, by the use of a 6 : 1 gear slowing down the motion of the arm, the depth scale can be altered to read in fathoms instead of feet when the depths grow greater. It needs emphasis, however, that the new instrument has not been developed to replace the older model. Indeed, the increased accuracy at shallow depths has only been obtained at the sacrifice of a desirable feature of the "straight line" model. Owing to the curved motion of the stylus a distorted representation of the profile of the sea bed is drawn, and on the traverse of a ship over the same course in the opposite direction the two profiles drawn would not, as in the "straight line" instrument, instantly be recognisable as identical. But where especially accurate measurement of depths, particularly shallow depths is required, as in marine surveying, it is the appropriate instrument to use. Several instruments of each kind are shown, each adapted for sounding to different depths or having modifications in detail to adapt them for particular purposes. In addition, instruments having no recording chart, but only a dial indicator, are also shown.

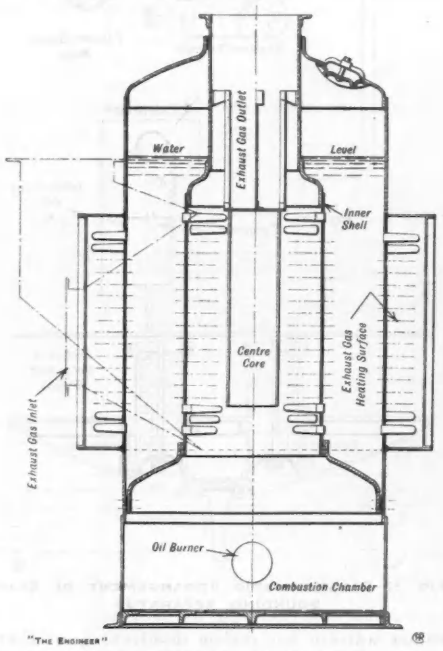


Fig. 34—Clarkson Thimble Tube Boiler—Babcock

Babcock and Wilcox, Ltd.

As in previous years, the firm of Babcock and Wilcox, Ltd., of London and Renfrew, is showing a full-sized section of a standard marine water-tube boiler in a furnace of Bailey construction, fired with a Babcock Erith-Roe marine-type stoker. This exhibit also serves to illustrate the firm's calorised Diamond soot blowers, and Babcock-Clyde soot blowers, while other exhibits on the stand include a two-colour water gauge illuminator, and standard pressure and steam-atomising oil burners, with a safety air-control box, designed for closed stokehold operation.

An interesting exhibit is that which has been arranged to show the latest developments made by the firm in fusion welding. The drum actually shown on the stand is a part of a similar boiler drum to that illustrated in Fig. 35, and has a length of 14ft. 6in., with a diameter of 4ft. 6in. and plate thicknesses of 1¼in. and 2in. The accompanying illustration represents one of a recent contract for eighteen B. and W. boiler drums, with a length of 31ft. 11in. and a diameter of 4ft. 6in., which were approved, inspected, and passed by Lloyd's Register of Shipping for a safety valve load of 290 lb. per square inch and a test pressure of 780 lb. per square inch. The drum exhibited at Olympia is arranged to stand on its open end with a mirror underneath so that the interior of the vessel can be readily seen, the end of one of the longitudinal seams being etched while the other welded section is left in its natural machined state. The circumferential seam by which the drum head is attached to the shell, and which intersects the two longitudinal seams, is the most difficult seam to make, and the whole of the radiographs for this seam, some 20ft. in length, are on view. A typical test piece also exhibited is a specimen bent through 180 deg. with a 45·7 per cent. elongation of the outside fibres and no sign of fracture. This excellent result, after such a strenuous test, may be compared with a minimum of 30 per cent. elongation for a Babcock Class I specification, and 20 per cent. for an ordinary specification. The excellent structure and quality of the all-weld metal is further exemplified by appropriate test bars and a twisted strip of metal. We record with interest that after a careful examination of the Babcock system of fusion welding, Lloyd's Register of Shipping has recently approved the firm for the manufacture of fusion-welded pressure vessels for land purposes to Lloyd's Class I specification.

Another small exhibit of interest to engineers is that showing hollow stanchions for hand railing. This is a new development, and is important, as, although the new hollow stanchion is indistinguishable from the standard solid-forged stanchion, its weight is only 7¾ lb., compared with 16 lb.

In Fig. 33 we reproduce sectional views of the Babcock "Handor" parallel slide valve which forms part of a full range of Babcock valves. As our illustrations clearly show, the design of the valve is such that the internal parts of the valve can readily be examined or completely withdrawn through a hand hole and door fitted in the valve body without breaking any joints in the steam line or lifting heavy valve covers. The door of a 14in. or 16in. Handor valve can quite well be removed single-handed without lifting tackle. This valve was exhibited at the recent British Industries Fair at Birmingham. There are also exhibited several examples of calorised parts, and Calmit chromium-nickel-aluminium alloy

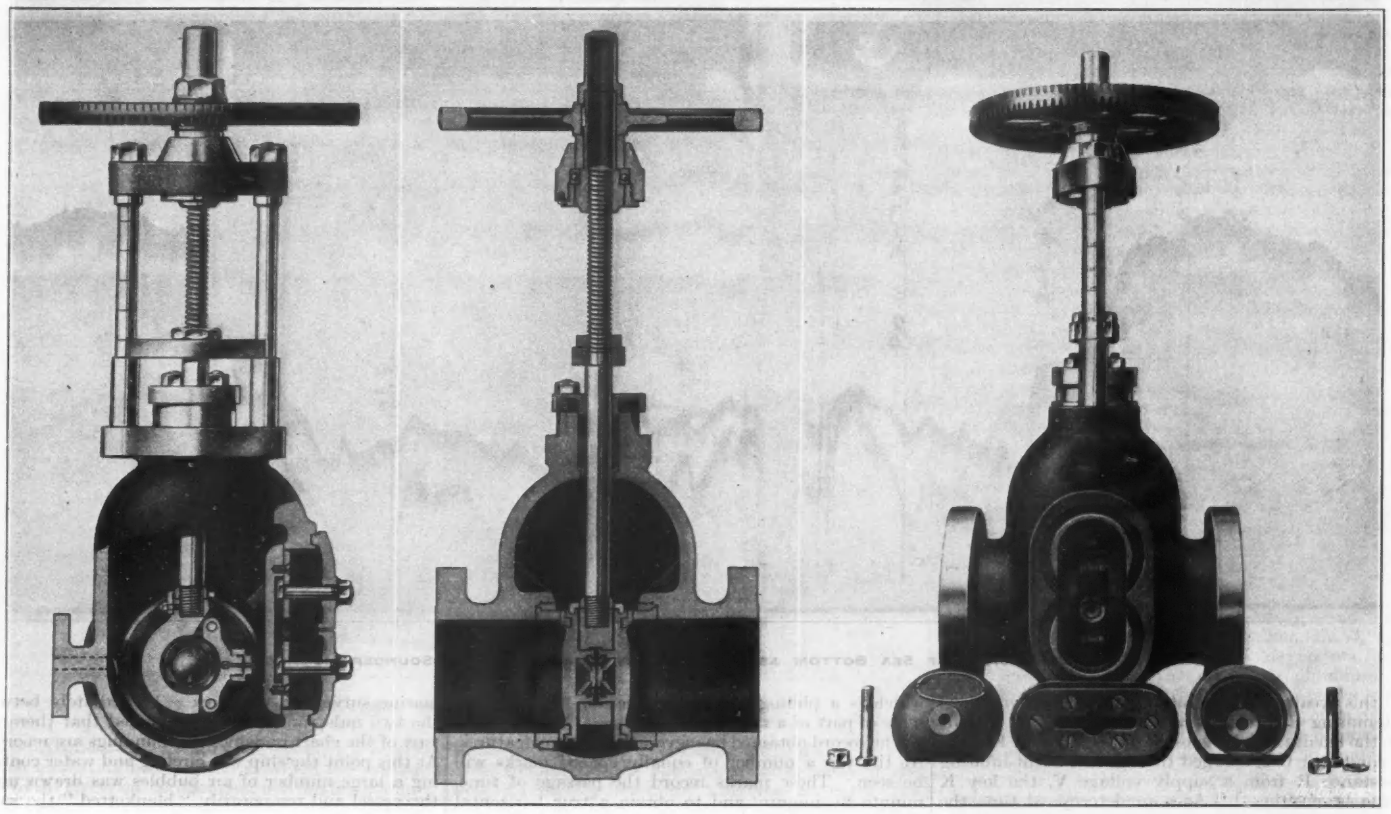


Fig. 33—The "Handor" Parallel Slide Valve—Babcock

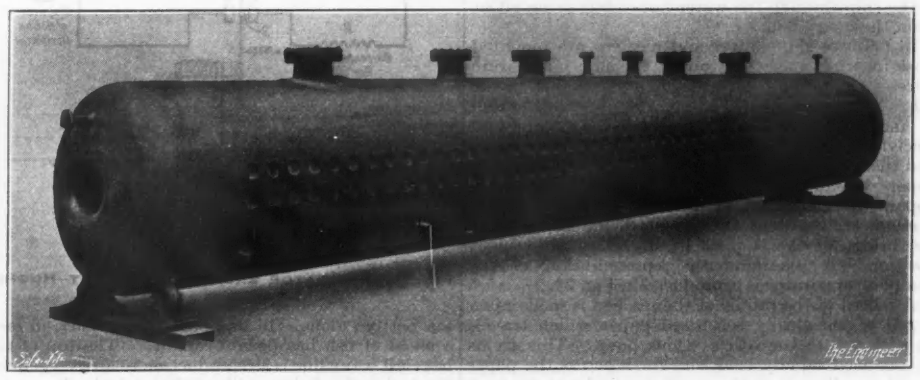


Fig. 35—Fusion Welded Pressure Vessel—Babcock

steel parts designed for high temperature use, while models are displayed of various types of Babcock boilers and cranes.

The associated firm, the Clarkson Thimble Tube Boiler Company, Ltd., is exhibiting various examples and drawings which show the firm's latest practice in waste-heat recovery. A new design of composite boiler for exhaust gas and oil-fuel-firing is illustrated in Fig. 34, which is one of two boilers now under construction for a large motor vessel. It has been specially designed to meet the requirements of shipbuilders to keep overall heights to a minimum. As our drawing shows, the exhaust gas heating surface is arranged around the outer shell and is separated from the oil-fired heating surface by a large annular water space, which permits easy inspection and cleaning when the boiler is emptied. In most designs of composite boilers hitherto available the exhaust heating surface has been placed directly above the oil fuel surface, and only separated from it by a plate not covered by water. As our drawing Fig. 34 indicates, the exhaust gases from the engine enter at the side of the boiler and pass round the outer annular casing and thence to the funnel, while the products of combustion from the oil firing pass upward through the centre of the boiler to the uptake. The firm is also exhibiting a range of thimble tubes made, we understand, by an improved method of manufacture which enables a tube of equal section throughout to be easily produced. These tubes vary from small thimble tubes 2 3/16 in. long and No. 16 gauge thickness, to the largest tubes, which are 24in. long and made of No. 9 gauge material.

WILLIAM BEARDMORE AND CO., LTD.

Some new and interesting designs of high-speed oil engines for land and marine work are to be seen on the stand of William Beardmore and Co., Ltd., of London and Glasgow. In Fig. XIV, on one of the art Supplement pages, we illustrate a new type of engine with a cylinder bore of 6½in. and a stroke of 9in., which has a designed normal output of 200 to 225 b.h.p. when running at 1000 to 2000 r.p.m. While the general design of the engine follows standard Beardmore practice, several improvements which make for reliable working, ease of inspection, and low maintenance charges, have been adopted. The main framing and cylinder casing are cast in one piece in nickel-chrome iron. At the top of the casing is a chamber in which the hollow cam shaft is carried. Inspection doors permit examination of the cam shaft and the removal of the connecting doors through the crank case. An underbed of nickel iron is used which can be fitted with an extension to carry auxiliary drives. The crankshaft is arranged to carry a vibration damper. All the running parts are of high-duty steel or non-ferrous alloys of special quality, while a high degree of accurate workmanship is used throughout. The cylinder heads are of aluminium alloy with the alloy steel valve seats cast in. Each head carries an air inlet and exhaust valve in line with an offset fuel valve, and air starting valve. The fuel pump embodies the latest Beardmore patent and is accommodated on the same side of the engine as the fuel valves and the cam shaft. The fuel injectors are of the closed differential spring-loaded,

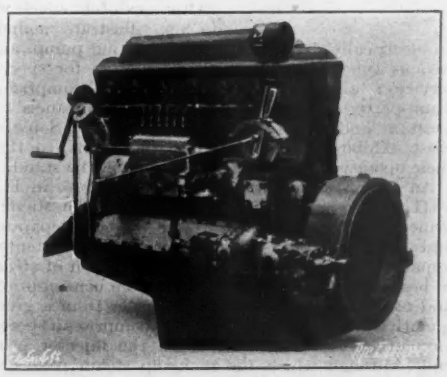


FIG. 36—58/85 B.H.P. OIL ENGINE—BEARDMORE

needle type. A close-speed regulator governor, which may be fitted with electrical solenoids for distant control, is fitted; also an emergency governor. The operating oil for the controlling system is obtained from the forced lubrication system. There are two lubricating oil pumps, which are mounted on the top of the vibration damper casing, and one is of the scavenge type and the other the pressure type. Other auxiliary pumps include booster pumps for the oil fuel and drain pumps, while a large circulating water pump and bilge pump can be provided.

The vibration damper is of the friction-slipper, fly-wheel type, with Feroasbestos discs.

Another engine, which we illustrate in Fig. 36, is the M.6 marine-type, built in four and six-cylinder units with a designed output of 36–56 b.h.p. at 1000 to 1600 r.p.m., and 58 to 85 b.h.p. at 1000 to 1600 r.p.m. The cylinder bore is 4¼in. with a 6in. stroke. Our illustration, Fig. 36, clearly shows the fuel pump and governor controls, and the arrangement of the auxiliary pumps, while the deep oil sump on the bed-plate may be noted, also the hand-operated starting gear at the front of the engine. The full-load fuel consumption of the engines above referred to is about 0·43 lb. per b.h.p. hour.

The firm is also exhibiting a model of the Beardmore Caprotti valve gear which has been successfully applied to recent Admiralty sloops and passenger and cargo liners, and also locomotives. Any Beardmore exhibit would not be complete without some reference to the products of the firm's Parkhead steel foundry and forge, and typical exhibits of the principal products of these works are shown on the stand.

REAVELL AND CO., LTD.

The Ipswich firm of Reavell and Co., Ltd., is showing, as usual, a large number of compressors and exhausters of the reciprocating and rotary types.

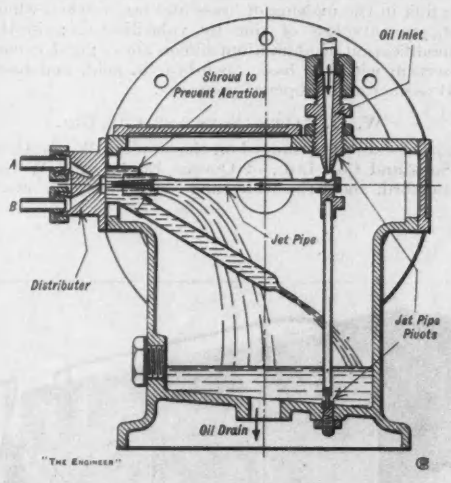


FIG. 37—ARRANGEMENT OF JET PIPE—REAVELL

We illustrate in XX a vertical, double-acting, two-stage, intercooled, reciprocating machine of 1500 cubic feet per minute of free air capacity, suitable for a maximum working pressure of 120 lb. per square inch, and running at 320 r.p.m. Three machines of this class, but of differing capacities, are shown. The general design has recently undergone revision, with the result that a number of improvements have been made. Essentially, however, the machines

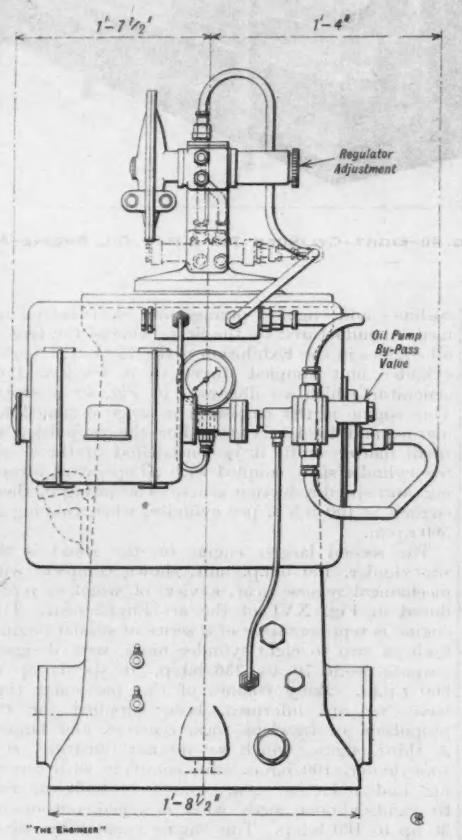


FIG. 38—GENERAL ARRANGEMENT OF REAVELL-ASKANIA REGULATOR

are the same as those exhibited on previous occasions, while the improvements that have been made are principally matters of detail design hardly suitable for description. It may be mentioned, however, that the high allowable rotational speeds make the compressors in this range particularly suitable for direct driving by electric motors or internal combustion engines.

Besides the two-stage machines a number of single-acting, single-stage compressors are shown, the capacities ranging from 300 cubic feet to 2 cubic feet of free air per minute. All are suitable for pressures up to 100 lb. per square inch. Some examples of similar compressors arranged as two-stage machines are suitable for pressures of 450 lb. and 1000 lb. per square inch. The rotary machines made by the firm are, of course, also to be seen on the stand, and include machines suitable for pressures up to 40 lb. per square inch. One of them is illustrated in Fig. XIX (Art Supplement).

One of the most interesting exhibits is the Reavell-Askania regulator, illustrated by the line engravings, Figs. 37 and 38. This regulator, which may be used for controlling such conditions as gas pressures, chimney draught, furnace temperature, or fuel-air ratio, &c., is particularly suited to boiler plants. It combines the functions of a "governor" providing the sensitive movement in accordance with small changes in the conditions, with the functions of a relay magnifying small impulses to the extent necessary for the operation of heavy valves. It consists, as will be seen from Fig. 37, of a jet pipe mounted in pivots so that it can swing in a horizontal plane and supplied through the hollow shaft with high-pressure oil. The horizontal movement of the jet pipe is controlled by means of a push-rod from a metering device, such as a thin metal diaphragm acting upon one side and a spring acting in opposition on the other. Where a ratio has to be maintained between two pressures, two diaphragms of suitable sizes can be balanced against one another through the jet pipe. The high-pressure oil supplied to the jet pipe emerges from the end at high velocity and impinges on a plate in which two passages are bored. These two passages lead to opposite ends of a cylinder containing a piston, which is connected by a suitable mechanism to the flap valve or other control device to be operated by the regulator. Except when the jet impinges on the plate midway between the two passages there will be a higher pressure on one side of the piston than on the other which will cause it to move. The resulting opening or closing of the flap valve will cause a change in the conditions such that the jet pipe is slowly swung back into the central position again. When the jet is in the mid position a considerable pressure is maintained on each side of the piston sufficient in most cases to ensure that the flap valve shall not be moved by eddying of the flow through the pipe or any other extraneous circumstances. The jet pipe has a limited motion, and, as will be seen from Fig. 37, its outlet end is enclosed in a tank, which is full of oil always, so that no air can be drawn in by the suction of the jet. The second line engraving, Fig. 38, shows how a regulator and the motor-driven oil pump required for its operation can be neatly mounted on a pedestal. On the stand various applications of the device are shown, and visitors are able to see how, by suitable modifications of the arrangement or by the addition of subsidiary controlling devices, the instrument can be adapted to suit special conditions.

GEORGE KENT, LTD.

One of the instruments exhibited by George Kent, Ltd., of Luton, is certain to attract a very considerable amount of attention. It is a unit similar to those

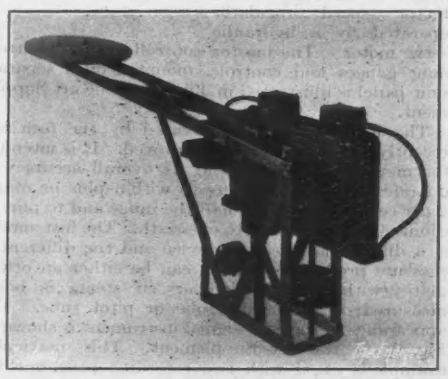


FIG. 39—AIR-FLOW TRANSMITTER METER—KENT

installed in the Mersey Tunnel for the measurement of air flow. As is well known, a modification of the transverse flow method of ventilation has been adopted for this tunnel. Fresh air is supplied through slots in the curbs, and is exhausted through perforated ceilings. The maximum delivery of fresh air to the tunnel is 2,500,000 cubic feet per minute, and an equal volume of air has, of course, to be exhausted if there is to be no undue longitudinal travel of the air. Necessarily, in order to keep the inlet and outlet flows and the flows to each part of the tunnel balanced against requirements at the point concerned, the flows need to be carefully measured. For this purpose measuring devices similar to that exhibited at Olympia and illustrated in Fig. 39, are placed at each of ten points in the intake shafts and at each of six points in the exhaust shafts. The readings of the meters are transmitted to the switch rooms of the various fan houses, and also to the central control room at George's Dock. At this latter point

the meters actuate recorders. The meters have been designed to work at maximum velocities which vary between 55ft. and 20ft. per second, and to indicate and record accurately down to 15 per cent. of the maximum velocity for which they are set to deal, while maintaining an accuracy which is within 5 per cent. of the actual air flow. As the velocities at the lower deliveries are as low as 3ft. per second, the instruments had to be specially designed for the purpose. The actual measurement is carried out by finding the deflection of a pivoted arm carrying at its free end a circular plate, upon the face of which the flowing air acts. This arm is so counterweighted that at zero velocity the plate is inclined towards the direction of air flow at 79°. Similarly, at maximum air velocity, the arm having swung through 22 deg., the plate is inclined away from the air flow at 79 deg. Both the zero setting and the loading weights are adjustable, so that the device can be adjusted for any maximum velocity. In order to exclude grit from the working surfaces, the knife edge on which the arm is pivoted is covered by mercury. A dash-pot is connected to the arm to damp out oscillations, and as the arm has a free period of about 5 seconds, its responses to changes of air flow are dead beat and rapid. The motion of the arm is transmitted through a long bearing into a transmitter box. Here the motion is caused to alter the contact point on an oil-immersed potentiometer resistance, which is connected across supply cables with 100 volts across the terminals. By suitable design of the contact points, an equally spaced flow record is obtained on the recording mechanism at the further end of the electrical circuit. This type of electrical transmitting device is well known, and we need only mention in connection with it that the actual consumption of current is about 10 milliampères for the indicating and 20 milliampères for the recording instruments. Except for the fact that their clocks are spring-driven and electrically wound—with the advantage that in case of failure of the electrical supply 20 hours "reserve" is stored in the spring—there is nothing unusual about the recording instruments. A simple gear change enables the chart speed to be varied at will between 1in. per hour and 1in. per minute.

Among other exhibits on the stand the automatic boiler control panel is interesting. It has mounted upon it a three-point draught gauge, a fuel air ratio controller, and a motor speed regulator operated by a hydraulic servo motor. The master controller with its attendant gauges and controls, mounted on a separate unit panel is illustrated in Fig. IV of the art Supplement.

The K.M. meter manufactured by the firm has recently been considerably improved. It is intended for metering any fluid and its overall accuracy is guaranteed by the makers to within plus or minus 2 per cent. down to one-half the range and to plus or minus 4 per cent down to one-sixth. The instrument is a differential pressure device and the differential pressure producing medium can be either an orifice plate (with cooling chambers, if steam is being measured) or a venturi tube or pitot tube. The appearance of the re-designed instrument is shown in Fig. V of the art Supplement. This particular example is fitted with two recording pens, one for the differential and the other for the static pressure.

IMPERIAL CHEMICAL INDUSTRIES, LTD.

In the Foundry Trades Section of the Exhibition, Imperial Chemical Industries, Ltd., of Millbank, London, is concentrating its exhibit mainly on the use of sodium carbonate for the refining of cast iron and non-ferrous metals. The granular salt and fused blocks of it are shown, together with plant used in the process and samples of ferrous and non-ferrous castings. The sodium carbonate process consists of the treatment of metals with a highly reactive slag, which has a refining, degasifying action, and removes sulphur, oxides, silicates, &c. Castings so treated are claimed to be sounder and free from porosity, and to have better machining properties, while for those required to withstand hydraulic pressure the treatment is specially useful. The reduction of the sulphur content is of particular value in connection with steel-making, and with sodium carbonate it is frequently possible to use a cheaper mixture in the cupola. As far as plant for use with the process is concerned, the most important exhibit on the stand is a specially designed tea-pot ladle which facilitates the separation of the slag from the metal. For use in the ladle the granular form of the chemical is provided. The fused block form of sodium carbonate is suitable for addition to the cupola charge. Each block weighs 4 lb. Its use makes the slag more fluid and keeps the furnace lining clean.

Sodium carbonate is also, we understand, used as a flux in the melting of brass and large swarf, where it prevents loss of zinc by volatilisation; in the modification of aluminium silicon alloys; and in connection with the basic open-hearth, acid, and basic Bessemer and Tropenas processes.

W. H. ALLEN, SONS AND CO., LTD.

The exhibits arranged on the stand of W. H. Allen, Sons and Co., Ltd., of Queens Engineering Works, Bedford, show the wide range of oil engines, steam turbines and engines, pumps, and electrical equipment manufactured by the firm. One of the largest oil engines in the Exhibition is the 730 b.h.p., eight-cylinder unit coupled direct to a 500-kW D.C. generator, which we illustrate in Fig. 40 herewith. This engine is the largest in a range designed for marine and land services. For the propulsion of small marine craft, it is constructed in three and five-cylinder sizes, coupled with oil-operated, reversing, and speed-reduction gears. The rating of these engines is 100 b.h.p. per cylinder, when running at 560 r.p.m.

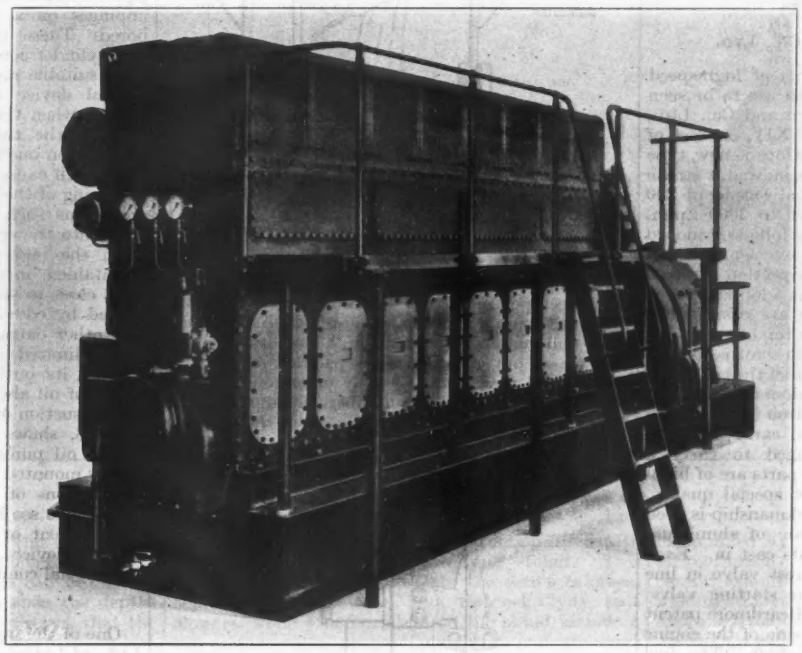


FIG. 40—EIGHT-CYLINDER 730 B.H.P. OIL ENGINE—ALLEN

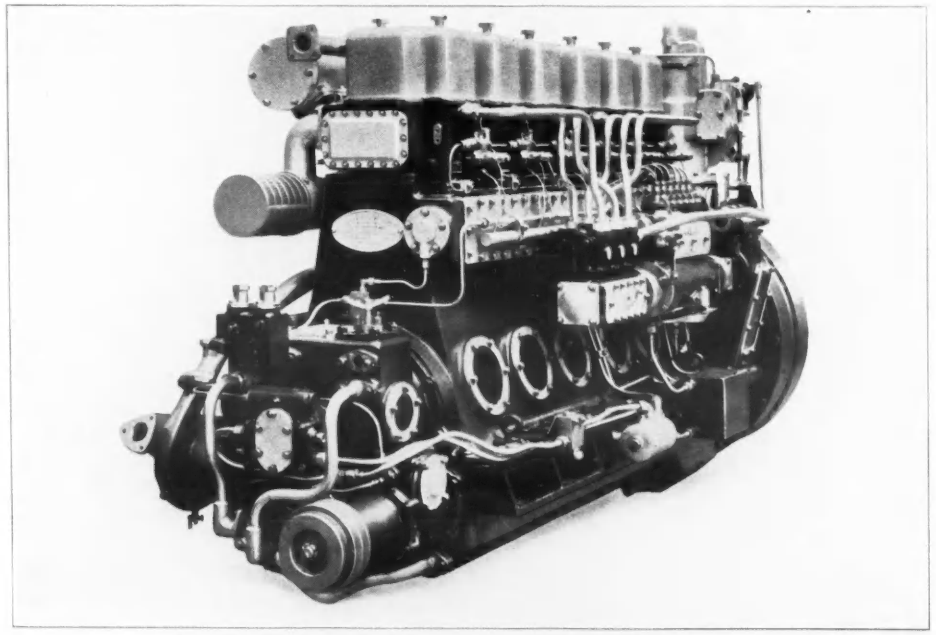
The second largest engine on the stand is the six-cylinder, 160 b.h.p. unit, shown complete with mechanical reverse gear, a view of which is reproduced in Fig. XVI of the art Supplement. This engine is representative of a series of similar engines built in two to eight-cylinder units, with designed outputs from 70 to 336 b.h.p. at speeds up to 600 r.p.m. Many engines of this particular type have, we are informed, been supplied for the propulsion of trawlers, tugs, coasters, and barges. A third engine, which we do not illustrate, is a six-cylinder, 100 b.h.p. unit, complete with reversing and reduction gear, which is built in two to eight-cylinder sizes with designed outputs of 30 up to 160 b.h.p. This engine is specially suited to conditions calling for low headroom, small space, and light weight. All the engines above referred to operate on the four-stroke principle with airless injection. They are designed for cold starting, and have a high efficiency with low running and maintenance costs. The full-load fuel consumption ranges between 0·385 lb. and 0·41 lb. per b.h.p. hour, according to the size of unit. Features of the Allen oil engine design, which have been fully described in previous articles, include the "C" frame construction, and the complete enclosure of all running parts, giving a clean outline with silent running.

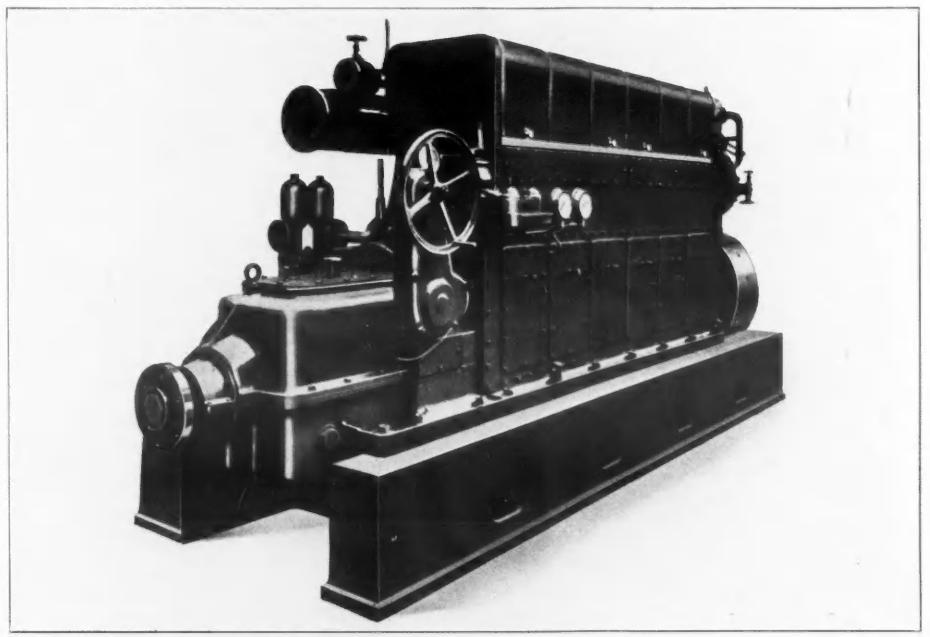
The steam side of the firm's business is well represented by the 50-kW turbo-generator set, designed for marine service or house turbine, and the steam-driven circulating pump, the first of which is illustrated in the art Supplement, Fig. X. In the turbo-generator set the design of the turbine and single helical reduction gearing follows the firm's standard practice, and is complete with its forced lubrication system and overspeed trip gear. The turbine may be operated either under vacuum or against back pressure, and hand operated adjustments are provided for, which enable the unit to operate economically under these differing conditions of exhaust. The generator is of the Allen D.C. shunt-wound pattern, with pipe ventilation, and is designed to operate at 1250 r.p.m. The main circulating pump, which is also turbine-driven, is generally similar to those fitted to the Orient liner "Orion," and described in THE ENGINEER of August 30th. The maximum output of the turbine driving the pump is 256 b.h.p., and the pump branches are 27½in. diameter with a normal output of 15,300 gallons per minute against a 30ft. head, and 17,500 gallons per minute against a 35ft. head.

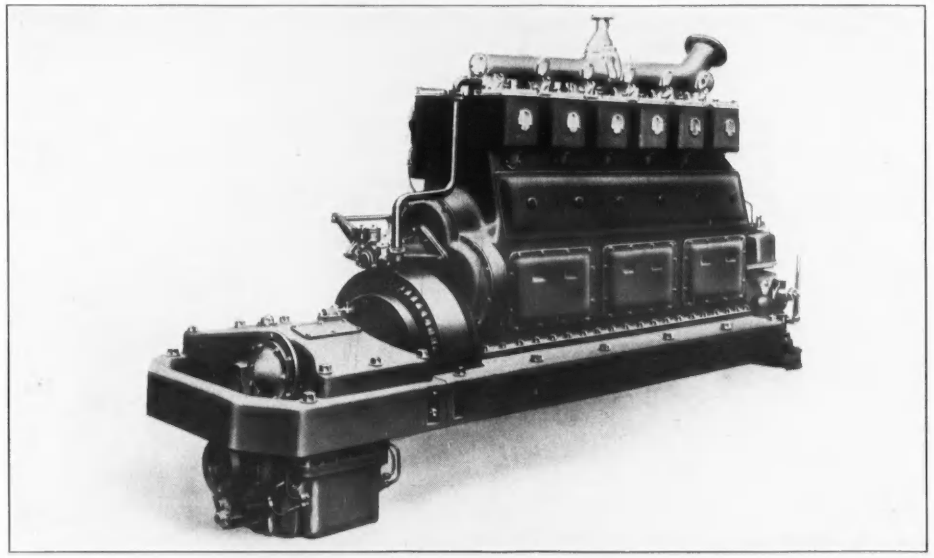
The firm is also showing a 60-kW steam engine-driven generating set, which we illustrate in Fig. XI of the art Supplement. It comprises a compound, enclosed-type steam engine coupled directly to a shunt-wound, pipe-ventilated D.C. generator. The engine is of a type manufactured by the company for several years, but it embodies several improvements. These include duplicate pumps for the forced lubrication system, a tubular oil cooler, a centrifugal circulating water pump for the cooler, and an emergency governor, in addition to the normal crankshaft-type governor. The whole unit is mounted on a fabricated bed-plate, and in this connection attention may be called to the scientific use of welded construction in practically all the items shown on the stand.

Other exhibits which we do not illustrate include an electrically driven vertical circulating pump, and various types of generators and motors for special services; also electrical control gears, comprising drum-pattern controllers, and automatic panels for constant and variable-speed D.C. motors. Some of these exhibits are connected to the mains, so that their operation can be demonstrated on the stand.

An interesting exhibit which we illustrate in Fig. VIII is a steam circulator working on the Miersbe principle, which is complete with a steam separator and a steam trap. The object of this patented apparatus is to create an active circulation of steam in heating circuits at all rates of steam consumption, and to obtain maximum heat transfer from a given quantity of steam. The apparatus comprises a special circulating valve constructed on the injector principle, through which the make-up steam passes to the heating system; a steam separator to remove the condensate from the circulating system; and a steam trap for collecting and discharging the condensate. These three component parts are connected in a closed circuit, so that the make-up steam, which is injected through the circulating valve, picks up and repasses the circuit steam, drawing it through the separator, from whence the condensate is removed and delivered to the trap. The injector is so designed that even at very low rates of make-up steam sufficient velocity is maintained to keep the steam in constant circulation throughout the system.







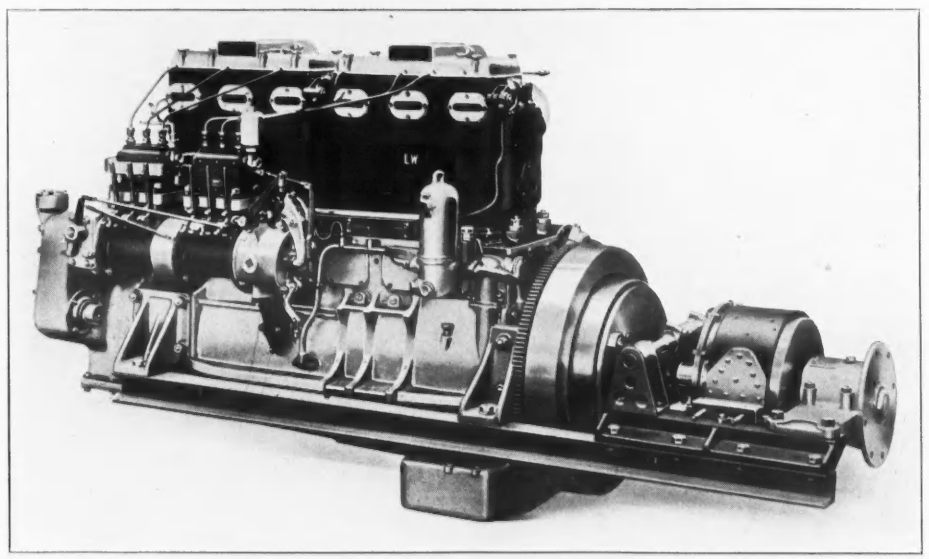


FIG. XIV (ABOVE)—225/250 B.H.P. ENGINE—BEARDMORE
FIG. XV (BELOW)—240 B.H.P. ENGINE—NATIONAL

FIG. XVI (ABOVE)—160 B.H.P. ENGINE—ALLEN
FIG. XVII (BELOW)—102 B.H.P. ENGINE—GARDNER

ROTARY AND RECIPROCATING COMPRESSORS AT OLYMPIA

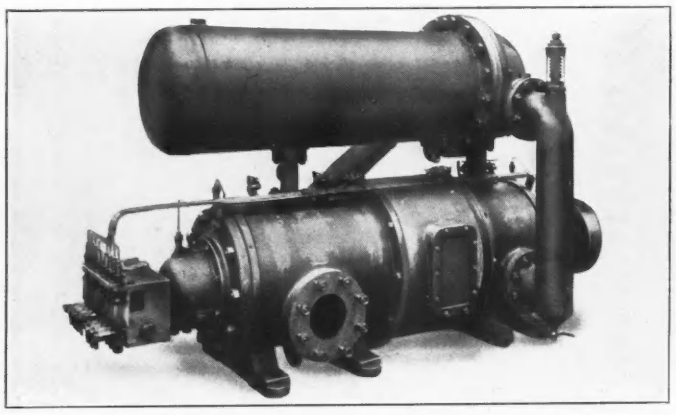


FIG. XVIII—ROTARY WATER-COOLED COMPRESSOR—HICK, HARGREAVES

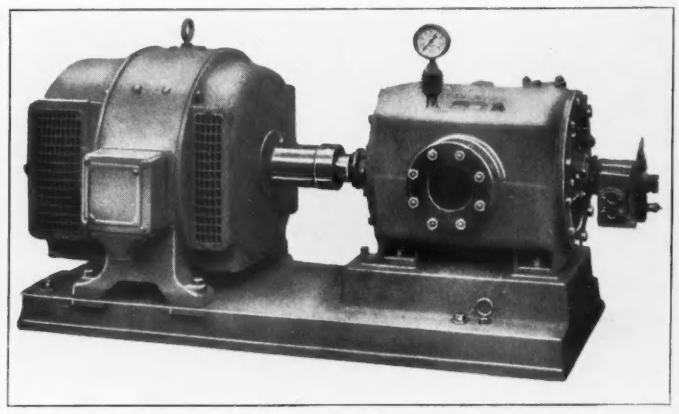


FIG. XIX—ROTARY WATER-COOLED COMPRESSOR—REAVELL

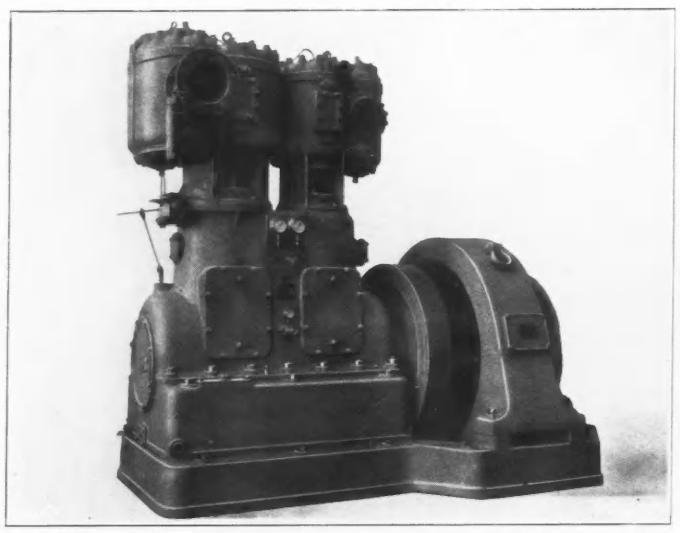


FIG. XX—TWO-STAGE DOUBLE-ACTING AIR COMPRESSOR—REAVELL

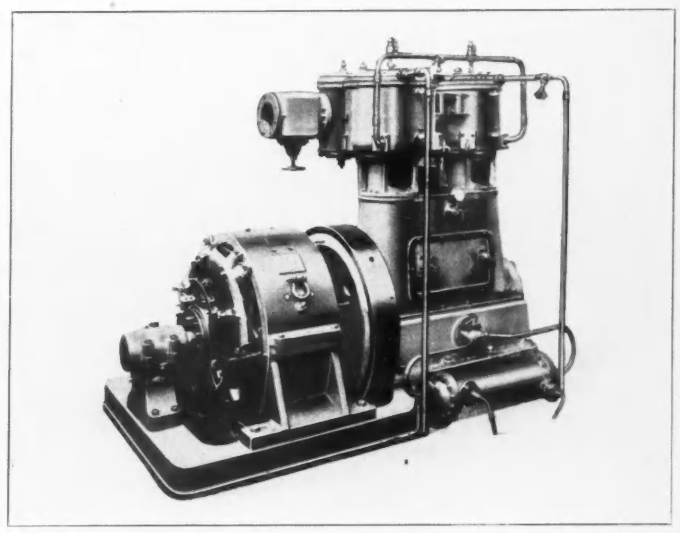


FIG. XXI—TWO-STAGE MOTOR-DRIVEN COMPRESSOR—BROWETT-LINDLEY

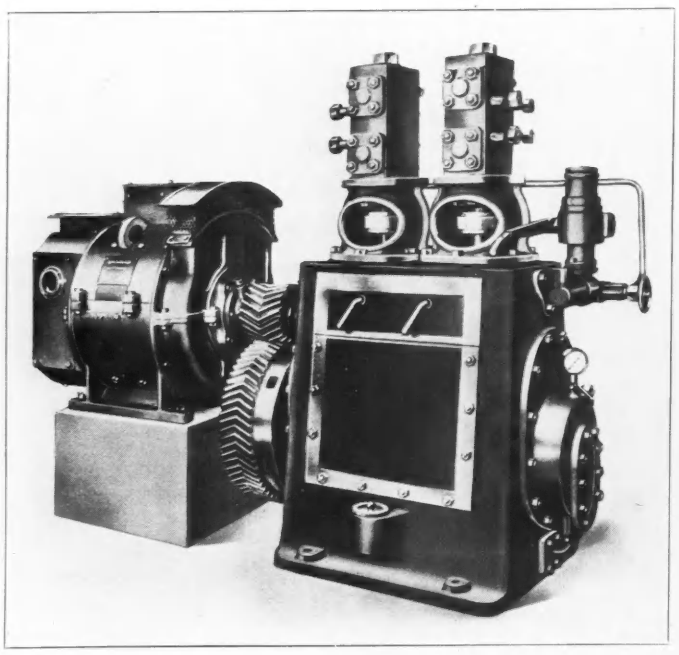


FIG. XXII—TWO-CYLINDER CO_2 COMPRESSOR—HASLAM

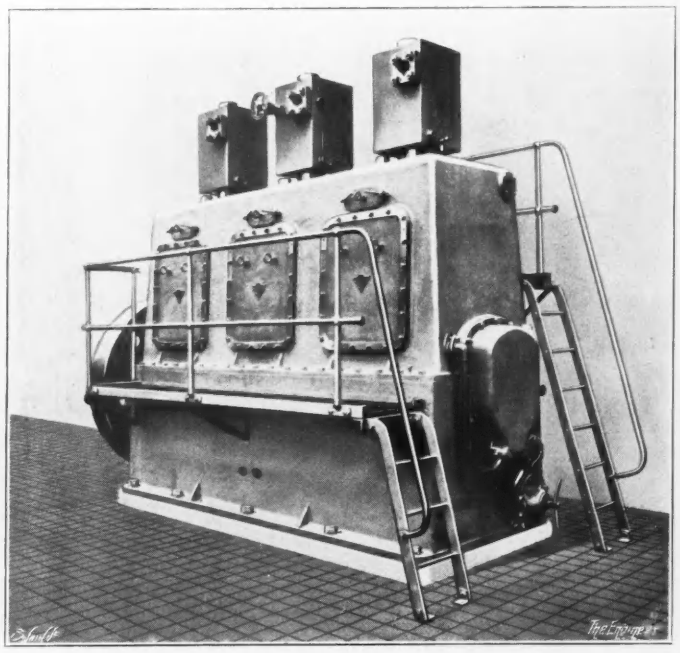


FIG. XXIII—THREE-CYLINDER CO_2 COMPRESSOR—HALL

Markets, Notes and News.

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quotations are f.o.b. steamer. A comprehensive list of the prices of materials mentioned below will be found on the next page.

Some Minor Export Markets.

In these days of keen competition in export trade even the smaller markets are of importance to British manufacturers, and from this point of view the publications of the Department of Overseas Trade generally contain some matter of interest. For instance, in a review of the economic conditions in Newfoundland (price 2s. net) it is stated that whilst British trade has improved, this is due to increased efforts on the part of Newfoundland importers, as, generally speaking, British firms have not capitalised the advantages they have in the sentimental attitude of the people and the tariff preference. The consumption of iron and steel and similar manufactures in Newfoundland is not important, but Great Britain is now the principal supplier of the island's requirements. Opportunities, however, exist for further improvement in such items as iron and steel pipe, railway bars and wheels, and boiler tubes. The imports of British machinery during 1934 totalled only 87,861 dollars, against Canadian and American imports valued at 247,812 dollars and 216,297 dollars respectively. With an anticipated expansion in local industries, however, there should be an opportunity to sell woodworking and farming machinery and marine and Diesel engines. A review of the economic conditions existing in Cuba (price 1s. 6d. net) states that 90 per cent. of Cuba's iron ore deposits, estimated at three and a-half billion tons, is held as a reserve by American steel companies. They are said to average 1·75 per cent. chromium, and when the use of stainless steel becomes more extensive this reserve may be drawn upon. Machinery and electrical machinery are chiefly imported from the United States, whilst the absence of constructional work has affected the sales of iron and steel during the last two years. In another review on conditions in Cyprus and Malta (price 2s. 6d. net) it is reported that in the case of the former country Great Britain supplied bars, rods, plates, sheets, &c., to the value of £2321 in 1934, compared with £11,807 by Belgium and £2137 by Germany. In tubes and pipes, however, Great Britain supplied goods to the value of £11,925 out of a total of £13,749 imported. Trade in iron and steel in Malta during 1934 was valued at £31,960, of which the British share was £6218. Belgium, on a price basis, obtained business to the value of £19,702 and Germany to the extent of £4176. The British share, however, represented an increase of about 65 per cent. on 1933. These reports can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.

Pig Iron.

Considering the extent to which users of pig iron covered themselves forward at the beginning of this half-year, the volume of business in miscellaneous parcels reaches a substantial tonnage. The demand, in fact, shows signs of broadening, as various branches of the consuming industries are increasing their outputs. Perhaps it is only natural that with the market in this condition reports are current that additions are to be made to the number of furnaces in blast. The producers, however, are following a cautious policy in this respect and seem to be trying to adjust their output to the demand. Whilst stocks are not more than normal in most districts, added to the production, they are sufficient to enable the producers to meet current requirements; but if the demand continues to expand fresh furnaces will have to be put into operation. On the North-East Coast the position is more stringent than in other districts, and there are indications that the autumn demand will develop considerable strength. Stocks in the makers' hands which are not earmarked against contracts are negligible, and as the requirements of the Scottish as well as the local users are growing there is some justification for the belief that production in this district will be increased. Inquiry upon export account has broadened of late, but low prices have to be accepted, and this side of the business is not attractive to the producers in the conditions now ruling. In the Midlands the autumn demand is developing satisfactorily. The requirements of the light foundries are becoming stronger, whilst the position at the engineering foundries also has improved. In the Lancashire district it is reported that the tonnage of iron passing into consumption is greater than at this time last year. New business, however, has not been on a heavy scale, since most consumers booked substantial contracts immediately before the holidays. The demand in Scotland is principally for small parcels, but good quantities are passing into consumption. Business with the light castings makers, which for a time was rather slack, has definitely improved during the past fortnight. Although new contracts for hematite have not been given out upon any scale lately, the producers continue to make important deliveries to consuming works.

The North-East Coast and Yorkshire.

There has been no slackening in industrial operations on the North-East Coast. All the works have good order books and are finding no cause for complaint at the way in which specifications against contracts are coming to hand. The works producing railway material are not so busy as they have been, as recently some contracts have been completed. The demand from the shipbuilding yards on the Tyne, also, although improving, is by no means up to the hopes entertained earlier in the year. However, the Tyne shipbuilders hope to benefit from the new naval construction programme, and this should be reflected in large orders for the local steel works. The constructional engineers are busy and have some important jobs on hand. As a result they are taking good quantities of structural steel, but the demand is noticeably better for heavy angles and shapes than for the lighter sorts. The position of the departments producing semi-finished steel material is particularly good. Now that the Continental quota for the period ending in November has been sold a fresh influx of orders from British consumers is reaching the makers. In fact, some of them are finding it difficult to meet the pressure for delivery. The demand is principally for billets, but some improvement has been noticeable lately in the call for sheet bars. The latter price is not controlled and is showing a tendency to advance. Not very long ago it was easy to obtain supplies at £5 d/d, but latterly £5 2s. 6d. to £5 5s. has been the general quotation. Steady conditions rule in the Yorkshire steel market, and although few big contracts have been placed lately, there has been an active trade passing in small parcels. In the Sheffield district the call for special steels, which slackened during the holiday period, has shown signs of expanding, and this is particularly the case with regard to aircraft steel. The re-rolling works are well employed and in several cases are operating at full time. The engineering shops and forges are busy and can see their way to continue the present rate of activity until the end of the year. The sheet makers could do with more orders on their books, but they are expecting a seasonal revival in the demand from the motor industry.

Scotland and the North.

The satisfactory conditions which have ruled in the Scottish steel industry for several months show no indication of deteriorating, and although over 60 per cent. of the building berths in Clyde shipyards are not in use, recent new orders and others which it is expected will be obtained by Scottish firms have inspired a spirit of optimism in the steel and allied industries. The engineering works have obtained some important orders lately and are likely to provide a good outlet for steel materials for some time. The constructional engineers also have big contracts in hand, and it is improbable that the demand for joists and sections will decline this year. The works producing bar iron, however, are not so well employed as they might be, although their position has considerably improved as a result of the duties and the Anglo-Continental steel agreement. On the other hand, the re-rolling mills are operating almost at full time on steel bars, strip, and small sections. A constant flow of orders for these descriptions is reaching the works and the situation is better now than it has been for years past. Whilst the sheet makers are better employed than they were a few weeks ago, the demand on home account is not so strong as earlier in the year. The business transacted is principally in the heavier gauge sheets, but lately there has been some expansion in the overseas requirements of the thinner descriptions. The call for galvanised sheets is weak and few signs of improvement can be discerned in that market. In the Lancashire district business in most departments has become more active since the month opened. There is still an absence of important contracts for plates, but the busier conditions which now exist at the locomotive works should result in an improvement in this direction. Business in structural steel is satisfactory and some of the constructional engineering firms have been in the market for good quantities. Most of the works are well supplied with orders for this class of material, and specifications are reaching them with regularity. The North-West Coast steel works are well employed and recently have made heavy deliveries of bars, rails, billets, and sleepers. The Barrow mills also are busy on rails, hoops, and strip.

Current Business.

The Kelvin Construction Company, Ltd., of Glasgow, has secured an important contract for the erection at Coventry of flight sheds and workshop buildings for the production of the largest type of aeroplane built in this country. The materials will be fabricated in Glasgow. The Rand Water Board has ordered two high-efficiency centrifugal pumps, one of 14 million and the other of 12 million gallons per day capacity, from the Harland Engineering Company, Ltd., B.E.P. Works, Alloa. Another South African order which has been secured by the company is for eighty-four electric motors ranging from 2 to 60 h.p., and an India order for 200 electrically driven pumping sets. An order for two cargo vessels has been placed with R. and W. Hawthorn, Leslie and Co., Ltd., Hebburn-on-Tyne. A contract for a passenger vessel for the Newfoundland coast trade has been placed with Fleming and Ferguson, Ltd., of Paisley. The Rand Water Board has placed a pipe contract valued at £371,108 in this country. Half has been placed with the South Durham Steel and Iron Company, Ltd., and the remainder with Stewarts and Lloyds, Ltd., and the British Mannesmann Tube Company, Ltd. Mr. A. N. McQuistan, a director of the Cargo Fleet Iron Company, Ltd., is to visit America to inspect the cold rolling of sheets at various American plants in connection with his company's intention to lay down plant for producing cold rolled and pressed sheets of a greater width than any yet produced in this country. The Department of Overseas Trade announces that the following contracts are open for tender:—Argentine State Railways: mild steel plain sheets and round, square, and flat rods, angles and sections (Buenos Aires, October 10th); Great Indian Peninsular Railway: mild steel bearings and floor system, &c.; six 63ft. 6in. semi-through spans for Nalganga Bridge (Bombay, September 30th); Indian Stores Department: steel axles for coaching and goods stock (Simla, October 8th); Singapore, Municipal Water Department: brass bent and straight ferrules (London or Singapore, November 4th); South Africa, Bellville (Cape Province) Village Management Board: cast iron pipes, special castings, valves, &c. (Bellville, September 26th).

Duties on Drills and Pliers.

From September 4th duties have been imposed upon twist drills, pliers, pincers, and nippers, a development which will be of interest to many branches of the engineering industry. The rates are as follows:—

Cylindrical, helically grooved drills, commonly known as twist drills, bit stock drills and machine bits for wood (but not including augur bits) not exceeding $\frac{1}{16}$in. in diameter, 6d. per dozen, or 20 per cent., whichever is the greater; exceeding $\frac{1}{16}$in., but not exceeding $\frac{1}{4}$in. diameter, 1s. 6d. per lb., or 20 per cent., whichever is the greater; exceeding $\frac{1}{4}$in. in diameter, 20 per cent.

Pliers, pincers and nippers (excluding medical, surgical, dental, veterinary, and dissecting instruments and nail nippers and nail clippers), if the value does not exceed 9s. per dozen, 1s. 6d. per dozen, or 33$\frac{1}{3}$ per cent., whichever is the greater; if the value exceeds 9s. per dozen, 3s. per dozen, or 20 per cent., whichever is the greater.

Parts of any of these articles, if the value does not exceed 4s. 6d. per dozen parts, 9d. per dozen parts, or 33$\frac{1}{3}$ per cent., whichever is the greater; if the value exceeds 4s. 6d. per dozen parts, 1s. 6d. per dozen parts, or 20 per cent., whichever is the greater.

The Committee report that the market for twist drills of the cheaper variety made of carbon steel has for a long period been supplied largely from abroad. Some success has been achieved by British manufacturers in capturing a share of the market; but recently foreign competition has been intensified and quantities have been imported at prices against which the home producers cannot compete. Twist drills made of high-speed steel should, owing to their higher value, remain unaffected by the new scale of specific duties and remain subject to the *ad valorem* duty of 20 per cent. On the subject of pliers, pincers, and nippers the Committee state that British manufacturers have gradually lost ground in recent years despite the reduction of their prices to the lowest possible economic level. There is keen foreign competition throughout the main range of these goods, but it is particularly severe in the case of the lower-quality tools which are imported in large numbers at prices which cannot be approached by the home industry, and the new duties are so framed as to afford increased protection for these classes.

Copper and Tin.

Business in the electrolytic copper market for the past week has fluctuated. At times American consumers have bought substantial quantities, but the general tendency in that market is for the demand to shrink. This is not surprising, considering the large tonnages which were purchased during August and in the first days of September. The domestic quotation in America remains at 8·50c. d/d, and the belief still exists that this price may be advanced. It seems improbable, however, in view of the decline in new business, that the producers will raise their quotation. On the other hand, the producing companies now should be in a fairly comfortable position for the remainder of the year, as a large number of forward contracts have been placed. Some makers are not keen upon selling further quantities for next year's delivery, although it is stated that inquiries for as far ahead as March have been made. It is possible, therefore, that sellers may decide to advance their price with a view to checking speculative purchases. Italy is still in the market as a buyer and when finance can be arranged is taking substantial quantities, whilst German purchases also have been important. In this country consumers have not covered themselves far forward, but a fair amount of copper is passing into consumption. The London standard market has been active and prices have shown a tendency to advance on a good volume of buying, chiefly, it is said, by Continental interests. . . . Conditions in the tin market have not developed any particular feature of interest. This week a meeting of the International Tin Committee will be held at Brussels, and, as is usually the case, dealers are inclined to mark time until this is over. It is not thought that any change will be made in the present quota, which, it is expected, will be renewed for the last quarter of the year. The tightness in the prompt position which has resulted in the backwardation remaining at around £10 per ton is still a source of annoyance to the market, but it is hoped that by the end of the month increased supplies from the East may relieve the position. Buying by consumers has not been active during the past week and in some quarters this is attributed to the disturbed international situation.

Lead and Spelter.

The situation in the lead market alters little from week to week. The demand from the consuming industries keeps steady at a high level and prices have moved within narrow limits, the tendency, if anything, being to advance. A strike at the Mexican lead mines has scarcely affected the market, although its continuance may cause a shortage of lead in Continental countries, which in turn might affect the supplies to the London market. There have been some arrivals of Empire lead of late, but apparently these were delivered in satisfaction of old contracts and did not come on the open market. Russia has been an important buyer and as there was no surplus lead arriving from overseas metal was taken out of warehouse in this country to supply the demand. Italy also has taken some good quantities, but the transactions have been limited to some extent by the difficulty of arranging terms of payment. . . . Steady, but uninteresting, conditions have ruled in the spelter market during the past week, but the tone has been firm and prices have shown a slight appreciation. The arrival of some spelter from Germany has resulted in the development of a contango. It is not anticipated, however, that the quantities reaching this country during September will be important. The price of the metal is still about 10s. below the lead quotation, but seems to be gradually overtaking it. There is fresh talk of the re-establishment of the Zinc Cartel, but although this would be welcomed by some producers, there seems little likelihood that sufficient unanimity could be obtained. The conditions which led to the breakdown of the Cartel, amongst which was the increasing production in Germany, still exist and would make agreement as difficult as when the organisation was dissolved.

Current Prices for Metals and Fuels.

Makers' official home trade prices, per ton, delivered buyers' stations. Sections, joists and plates are subject to a rebate to home users purchasing only from associated British Steelmakers: joists, 22s. 6d.; plates and sections, 15s. Export orders of 250 tons and over may be subject to special quotations.

PIG IRON.

	Home.	Export.
	(*D/d Teesside Area*)	
N.E. COAST—	£ s. d.	£ s. d.
Hematite Mixed Nos.	3 10 6	3 2 0
No. 1	3 11 0	3 3 6
Cleveland— (*D/d Teesside Area*)		
No. 1	3 10 0	3 4 0
No. 3 G.M.B.	3 7 6	3 1 6
No. 4 Forge	3 6 6	3 0 6
Basic (*Less 5/- rebate*)	3 10 0	—
MIDLANDS—		
Staffs.— (*Delivered to Black Country Station*)		
North Staffs. Foundry	3 11 0	—
„ „ Forge	3 6 6	—
Basic (*Less 5/- rebate*)	3 15 0	—
Northampton—		
Foundry No. 3	3 7 6	—
Forge	3 2 6	—
Derbyshire—		
No. 3 Foundry	3 11 0	—
Forge	3 6 0	—
SCOTLAND—		
Hematite, f.o.t. furnaces	3 13 6	—
No. 1 Foundry, ditto	3 12 6	—
No. 3 Foundry, ditto	3 10 0	—
Basic, d/d (*Less 5/- rebate*)	3 10 0	—
N.W. COAST— Hematite Mixed Nos.	3 14 6 d/d Glasgow 3 18 6 „ Sheffield 4 4 6 „ Birmingham	

MANUFACTURED IRON.

	Home.	Export.
LANCS.—	£ s. d.	£ s. d.
Crown Bars	9 12 6	—
Best Bars	10 2 6	—
S. YORKS.—		
Crown Bars	9 12 6	—
Best Bars	10 2 6	—
MIDLANDS—		
Crown Bars	9 15 0	—
Marked Bars (Staffs.)	12 0 0	—
No. 3 quality	7 10 0	—
No. 4 „	8 0 0	—
SCOTLAND—		
Crown Bars	9 12 6	9 5 0
Best	10 2 6	9 15 0
N.E. COAST—		
Common Bars	9 12 6	8 15 0
Best Bars	10 2 6	9 15 0
Double Best Bars	10 12 6	10 0 0

STEEL.

	Home.	Export.
LONDON AND THE SOUTH—	£ s. d.	£ s. d.
Angles	8 10 0	7 7 6
Tees	9 10 0	8 7 6
Joists	8 17 6	7 7 6
Channels	8 15 6	7 12 6
Rounds, 3in. and up	9 10 0	8 7 6
„ under 3in.	8 14 6	7 0 0
Flats, 5in. and under	8 14 6	7 0 0
Plates, ¼in. (basis)	9 0 0	7 15 0
„ ⅜in.	9 5 0	8 0 0
„ ½in.	9 10 0	8 5 0
„ ⅝in.	9 15 0	8 10 0
„ ¾in.	9 10 0	8 5 0
NORTH-EAST COAST—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Plates, ¼in.	8 15 0	7 15 0
„ ⅜in.	9 0 0	8 0 0
„ ½in.	9 5 0	8 5 0
„ ⅝in.	9 10 0	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates, ¼in.	9 5 0	—
MIDLANDS, AND LEEDS AND DISTRICT—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 17 6	7 15 0
„ ⅜in.	9 2 6	8 0 0
„ ½in.	9 7 6	8 5 0
„ ⅝in.	9 12 6	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates, ¼in.	9 7 6	7 15 0

STEEL (*continued*).

	Home.	Export.
GLASGOW AND DISTRICT—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 15 0	7 15 0
„ ⅜in.	9 0 0	8 0 0
„ ½in.	9 5 0	8 5 0
„ ⅝in.	9 10 0	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates	9 5 0	—
SOUTH WALES AREA—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 0
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 17 6	7 15 0
„ ⅜in.	9 2 6	8 0 0
„ ½in.	9 7 6	8 5 0
„ ⅝in.	9 12 6	8 10 0
„ ¾in.	9 10 0	8 5 0

IRELAND—	BELFAST. £ s. d.	REST OF IRELAND. £ s. d.
Angles	8 12 6	8 15 0
Tees	9 12 6	9 15 0
Joists	9 0 0	9 2 6
Channels	8 17 6	9 0 0
Rounds, 3in. and up	9 12 6	9 15 0
„ under 3in.	9 2 0	9 4 6
Plates, ¼in. (basis)	9 0 0	9 2 6
„ ⅜in.	9 5 0	9 7 6
„ ½in.	9 10 0	9 12 6
„ ⅝in.	9 15 0	9 17 6
„ ¾in.	9 12 6	9 15 0

OTHER STEEL MATERIALS.

	Home.	Export.
Sheets.	£ s. d.	£ s. d.
10-G to 13-G., f.o.r.	9 10 0	8 15 0
14-G. to 20-G., d/d	10 15 0	9 0 0
21-G. to 24-G., d/d	11 0 0	9 5 0
25-G. to 27-G., d/d	11 12 6	9 17 6

The above home trade prices are for 4-ton lots and over; 2-ton to 4-ton lots, 10s. per ton extra; and under 2-ton lots, 30s. per ton extra.

Galvanised Corrugated Sheets, Basis 24-G.

Home.	£ s. d.
4-ton lots and up	13 0 0
2-ton to 4-ton lots	13 7 6
Under 2 tons	15 0 0

Export: £12 15s. 0d., c.i.f. India.
„ £11 5s. 0d., f.o.b. other markets.
„ Scandinavian Markets free.

Tin-plates.
20 by 14 basis, f.o.b. Bristol Channel Ports, 18/2.
Tin-plate Bars, d/d South Wales Works, £5 5s. 0d.

Billets.	£ s. d.
Basic (0·33% to 0·41% C.)	6 12 6
„ Medium (0·42% to 0·60% C.)	7 2 6
„ Hard (0·61% to 0·85% C.)	7 12 6
„ „ (0·86% to 0·99% C.)	8 2 6
„ „ (1% C. and up)	8 12 6
Soft (up to 0·25% C.), 500 tons and up	5 10 0
100 to 250 tons	5 17 6
Rails, Heavy, 500-ton lots, f.o.t.	8 10 0
„ Light, f.o.t.	7 10 0

FERRO ALLOYS

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/3 per lb.	
Ferro Tungsten	3/- per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 15 0	7/-
„ „ 6 p.c. to 8 p.c.	£21 0 0	7/-
„ „ 8 p.c. to 10 p.c.	£21 0 0	7/-
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£34 0 0	11/-
„ „ „ 1 p.c. carbon	£36 5 0	11/-
„ „ „ 0·50 p.c. carbon	£37 5 0	12/-
„ „ „ carbon free	9½d. per lb.	
Metallic Chromium	2/5 per lb.	
Ferro Manganese (loose)	£10 15 0 home	
„ Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- p.u.	
„ „ 75 p.c.	£17 17 6 scale 6/- p.u.	
„ Vanadium	12/8 per lb.	
„ Molybdenum	4/6 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£200 to £205	
Cobalt	5/6 per lb.	

NON-FERROUS METALS.

Official Prices, September 11th.

		Home.	Export.
COPPER—			
Cash	£33 13 9 to £33 15 0		
Three months	£34 2 6 to £34 3 9		
Electrolytic	£37 5 0 to £37 15 0		
Best Selected Ingots, d/d Birmingham	£37 5 0		
Sheets, Hot Rolled	£64 0 0		
Tubes, Solid Drawn (basis)		10d.	10d.
„ Brazed (basis)		10d.	10d.
BRASS—			
Ingots, 70/30, d/d Birmingham	£30 0 0 to £31 0 0		
Tubes, Solid Drawn, 2/1 Alloy		9¼d.	9¼d.
„ Brazed		11¼d.	11¼d.
TIN—			
Cash	£219 0 0 to £219 5 0		
Three months	£209 0 0 to £209 5 0		
LEAD	£15 13 9 to £15 15 0		
SPELTER	£15 2 6 to £15 6 3		
Aluminium Ingots (British)	£100		

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Grangemouth)—Navigation Unscreened	13/- to 13/6
„ Glasgow—Ell	14/6 to 15/-
„ „ Splint	17/- to 17/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	12/- to 12/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—	
Prime Steam	13/- to 14/-
Unscreened Navigation	13/3 to 13/6
LOTHIANS—	
(f.o.b. Leith)—Hartley Prime	13/6 to 13/9
Secondary Steam	12/- to 12/6

ENGLAND.

YORKSHIRE, MANCHESTER—	
B.S.Y. Hard Steams	18/6 to 21/6
Furnace Coke	13/- to 16/-
NORTHUMBERLAND, NEWCASTLE—	
Blyth Best	13/9 to 14/3
„ Second	13/3 to 13/6
„ Best Small	10/6 to 11/-
Unscreened	12/6 to 13/6
DURHAM—	
Best Gas	14/8
Foundry Coke	19/- to 20/-

SHEFFIELD—	Inland.
Best Hand-picked Branch	23/- to 25/-
South Yorkshire Best	20/- to 22/-
South Yorkshire Seconds	17/- to 18/-
Rough Slacks	8/- to 9/-
Nutty Slacks	7/- to 8/6

SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Admiralty Large	19/6
Best Seconds	19/- to 19/4½
Best Dry Large	18/9 to 19/3
Ordinaries	18/3 to 18/6
Best Bunker Smalls	12/6 to 13/6
Cargo Smalls	11/6 to 12/6
Dry Nuts	22/- to 26/-
Foundry Coke	27/- to 40/-
Furnace Coke	19/- to 22/6
Patent Fuel	21/-
SWANSEA—	
Anthracite Coals:	
Best Large	36/- to 40/-
Machine-made Cobbles	41/- to 48/6
Nuts	40/- to 48/6
Beans	25/- to 30/-
Peas	19/- to 23/-
Rubbly Culm	11/- to 11/6
Steam Coals:	
Large Ordinary	18/- to 20/6

FUEL OIL.

Inland consumption; contracts in bulk.
Exclusive of Government tax of 1d. per gallon.

Ex Ocean Installation.	Per Gallon.
Furnace Oil (0·950 gravity)	3½d.
Diesel Oil	4d.

French Engineering Notes.

(From our own Correspondent in Paris.)

Coal Imports.

INCLUDED in the price reductions imposed by decrees as a means of bringing about a general deflation of values was one of 10 per cent. in the price of coal, and at the same time import quotas were tightened with the object apparently of providing coalowners with compensation. Industrial consumers complain that they are not profiting from the reduction, because the decrees do not indicate upon what basis it is to be determined, and coalowners are stated to have arranged their prices in a manner that renders the reduction to consumers illusory. Iron-founders complain that they are obtaining no reduction in coke prices, which they had counted upon for the benefit of their customers, who are consequently holding off the market. The more hopeful tone that followed upon the publication of the decrees has therefore weakened. More precision must be given to them if they are to produce the desired effect. If coalowners are unable, as they declare, to make further sacrifices, industrialists refuse to agree that they should be protected by a restriction of imports when all industries are endeavouring to follow the policy of deflation which is regarded as necessary for the salvation of gold currencies. These complaints against coalowners illustrate the difficulties which are being encountered in carrying out the deflation plan, with a progressive suppression of quotas, in face of the inertia of powerfully organised interests, and unless coal consumers are able to get the promised reduction in prices efforts will certainly be made to bring them down by competition with foreign coal.

Inventions.

Small inventors occupy a restricted space in the main hall of the Palais des Expositions, in Paris, where the annual exhibition is being held on their behalf. The inventions shown are usually of a character that denote more ingenuity than a practical sense of utility, but it is certain that these exhibitions will prevent old ideas from becoming obsolete. Aviation naturally appeals to inventors, and the performance of the German experimenter Duennbeil in making two flights of 195 m. and 235 m. with pedals, aided by the impetus given by a catapult, has encouraged French inventors to show devices that are of more popular than practical interest, notably planes fitted with pedals and bicycles equipped with planes. There is a model of an "autoscaphe" or floating stage for aeroplanes. It is a rectangular construction on floats with a flat roof for landing, and it contains an equipment of pumps and dynamos supposed to be driven by levers to which reciprocating motion is given by the action of waves on floats. The inventor believes that this energy will store water in tanks and put it under air pressure to drive a turbine and propeller. There are more serious attempts to deal with railway and road problems, particularly in the automatic control of level crossings with distant signalling, while models of arrangements to avoid collisions at road crossings suggest that motor traffic can be made safe with roads constructed on costly lines. There are always exhibits of multiple combination machine tools for small shops and some of the ideas are interesting, but in a general way the efforts of small inventors reveal little that is likely to advance technical construction. In the building there are also exhibits of work done by apprentices at professional schools organised by railway companies, the State arsenals and manufacturers. The maximum period of training is four years, and includes mathematics, mechanics, and drawing. There are altogether 722 professional schools subsidised by the State, and in 1934 the number of apprentices was 138,270. In view of the curriculum it is not surprising that many apprentices should prefer the drawing-office to the bench and that the plan is creating a dearth of good fitters and machine tool operators.

Ocean Seaplanes.

The fiftieth crossing of the South Atlantic by machines in the air mail service between Dakar and Natal, in Brazil, was made last week, and the fact that nothing has marred their regular running has removed doubts from the French mind as to the reliability of seaplanes for ocean travel. Being confined to the transport of mails, the service is necessarily costly, and it can never pay until sufficient passengers are carried in safety and comfort. For that purpose the Latécoère Company constructed the 37-ton "Lieutenant-de-vaisseau-Paris," which met with a mishap at Havre after taking part in the celebrations on the occasion of the "Normandie" leaving that port on her maiden voyage. The seaplane was intended for the South American route, but in view of the German plan to put an airship in service over the North Atlantic at an early date the French are hoping to anticipate it by running the "Lieutenant-de-vaisseau-Paris" by way of the Azores. Obviously, some time must elapse before the seaplane can be used for that purpose, since it will have to be thoroughly tested after repairs, and it is by no means certain that negotiations with the Portuguese Government for the use of the Azores as a station will be easily brought to a satisfactory conclusion. Meanwhile, the Latécoère Company is experimenting with a model of an 80-ton seaplane, but there is some doubt whether such a machine can be constructed on account of the cost, which appears to increase so rapidly with the tonnage as to suggest a relatively low limit to the economical transport of passengers across oceans that can only be traversed with a heavy load of fuel.

The "Dunkerque."

The 26,500-ton battleship "Dunkerque" will be floated out of the Salou construction dock at Brest on October 2nd, and preparations will be made at once for the building of the 35,000-ton battleship, to be named the "France," upon which work will be started about the middle of next month. As the length of the Salou dock does not allow of the "Dunkerque" being entirely completed, the battleship will be taken to another dock to be fitted with the final 17 m. length at the bow.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., 1s. each.

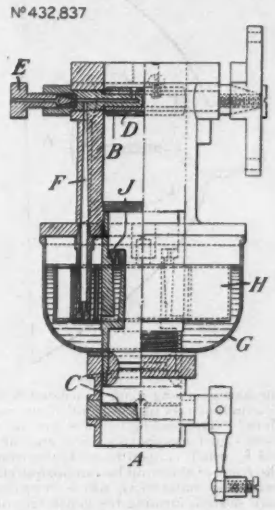
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

432,837. August 24th, 1934.—CARBURETTORS, E. A. Larrosa, General Salazar 12, Bilbao, Spain.

The air intake to this carburettor is shown at A, and the passage to the engine at B. In the intake there is a "strangler" C, which is virtually a throttle valve. Towards the outlet there is the main throttle D. Its spindle is bored and has an air inlet needle valve E. There is also a passage way F leading down to the constant level petrol chamber G, in which there is an annular

Nº 432,837

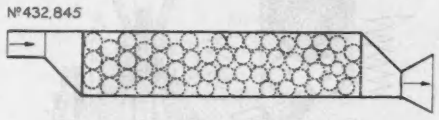


float H. For the purpose of starting up the engine the strangler C is closed. There is then produced a strong suction of air through E, which picks up petrol by the passage F and provides sufficient mixture for running the engine light. On picking up the load the strangler is opened fully and the throttle adjusted according to the load. The jets J then come into action to provide a working mixture, while the starting mixture is cut off by the relative movement of the throttle valve spindle and the stem of the valve E.—*August 2nd*, 1935.

432,845. December 29th, 1934.—EXHAUST SILENCERS, Degea Aktiengesellschaft, (Auergesellschaft), 16–19, Rotherstrasse Berlin 0.17, Germany.

According to this invention, inorganic sound-absorbing material having the nature of felt or cotton wool is formed into nodules, each of which is supported in a wrapping of wire netting, these nodules being packed into a tube of suitable size and cross-sectional shape, in which they are confined between perforated plates so that they are prevented from tumbling about. The shapes of the individual nodules are preserved by the wrapping of wire netting against the action of vibration

Nº 432,845



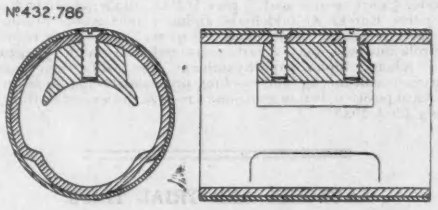
due to travel and against the percussive action of the exhaust. The nodules may be of any desired form (spherical, cylindrical, or even of tube-like form similar to Raschig-rings), and may be of different dimensions according to the size of the silencer, which, in turn, depends on the power of the engine. The exhaust gases pass through the interstices between the individual nodules which absorb the sound. The gases no longer leave the silencer in jerks, since they are compelled to pass through the tortuous paths between the nodules so that they are caused to pass out in a uniform, steady flow without noise. A preferred construction of the invention is shown in the drawing.—*August 2nd*, 1935.

DYNAMOS AND MOTORS.

432,786. March 26th, 1935.—FIELD MAGNETS, A. Schwarz, Marienhöhe, Eisenach, Germany.

According to this invention, the field magnet yoke is formed by a tube, preferably of circular cross section, which is pressed inwardly at the appropriate parts for the formation of the pole pieces or surfaces. The construction of the yoke is thereby considerably simplified and cheapened. The construction of double-pole machines is preferably so arranged that an iron

Nº 432,786



tube of the necessary clear cross section is provided with an indented part, the radius of which is adapted to the cross section of the armature. Opposite this pressed-in part, there is inserted a second pole piece as a separate independent part in the yoke. A separate sleeve can be placed around the yoke, which may be secured to the latter by means of the screws or the like which connect the pole piece with the field magnet yoke.—*August 1st*, 1935.

SWITCHGEAR.

432,606. May 24th, 1934.—ELECTRO-MAGNETIC STEP-BY-STEP SWITCHES, The General Electric Company, Ltd., Magnet House, Kingsway, London, W.C.2, and J. Eriksen, The Telephone Works of The General Electric Company, Stoke, Coventry.

This switch, for telephone operation, is of the single-plane type, and acts in both forward and reverse directions. The

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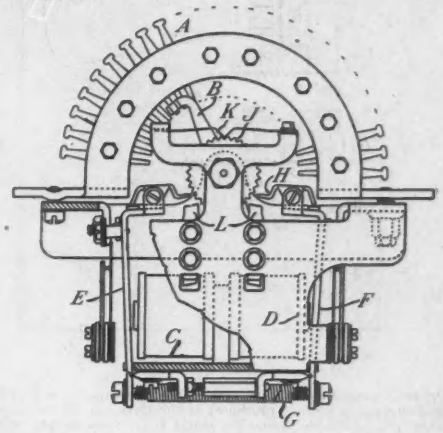


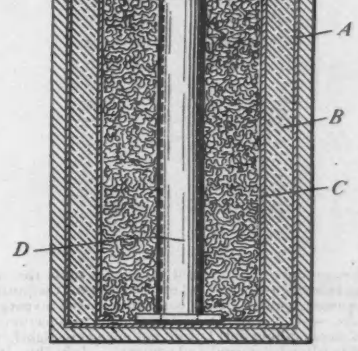
contacts are shown at A and the wiper at B. The actuating coils are marked C and D, and attract the armatures E and F against the resistance of the springs G. At the top of the armatures there are the pawls H, which work in conjunction with the ratchet wheel J on the spindle of the wiper B. There are a check catch K to hold the ratchet wheel, tooth by tooth, and stops L to limit the stroke of the pawls.—*July 30th*, 1935.

BATTERIES AND ACCUMULATORS.

432,775. November 6th, 1934.—STORAGE BATTERIES, L. Fuller, 160, Cromwell-road, Kensington, London, S.W.7.

This secondary cell is of the dry type—that is to say, it contains only just so much electrolyte as is held by capillary action. It has a negative conductor A, within which there is packed under pressure the layer of negative active material B.

Nº 432,775



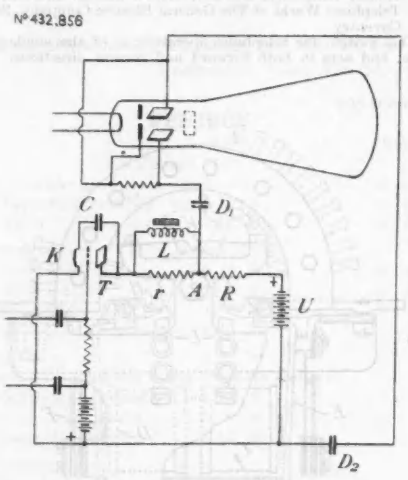
This material is subsequently electro-chemically converted into spongy lead. Within this layer there is a porous separator C and at the centre a lead positive conductor D. The surrounding space is filled with positive active material in the form of lead peroxide, crushed to a size of about one-hundredth of an inch, saturated with sulphuric acid having a specific gravity of from 1·2 to 1·4.—*August 1st*, 1935.

ELECTRICAL APPLIANCES.

432,856. March 8th, 1935.—SYNCHRONISING AND SCANNING DEVICES IN CATHODE RAY TUBES CONTROLLED BY GAS DISCHARGE TUBES, Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, 12, Place des Etats-Unis, Montrouge (Seine), France.

When for purposes of television, or other purposes, cathode oscillographs are used in which the deflection of the beam is given by the increasing charges on two condensers, discharged periodically by two grid-controlled gas discharge tubes, a defect is noticed in the linearity, as a function of time, of the charge on the condensers, in particular when the oscillations drop below a certain frequency. The invention obviates the above-mentioned defect. It consists in providing, in charging circuits of grid-controlled gas discharge tubes controlling the deflection of the cathode beam, a voltage which increases linearly as a function of the time, and based on the application to the deflector plates of a voltage formed by the normal voltage of the charging condenser increased by a correction voltage obtained by the passage of the charging current, obtained from the normal resistance, through an impedance formed by a self-inductance and by a resistance in shunt. The invention may be carried out by introducing into the charging circuit of the condenser, in series with the normal resistance, a complex impedance, in general, a resistance shunted by a self-inductance, and connecting a deflector plate, *e.g.*, one of the slow deflector plates of the oscillograph, not to the anode of the controlling gas discharge tube, but to a point situated between the normal resistance and the above-mentioned impedance, the other plate being connected to the cathode, these connections being effected by means of condensers of suitable value. The resistance R which serves usually for the passage of the charging current of the condenser C by the anode voltage U, is in series with the resistance *r* shunted by the self-inductance L. One of the slow deflection plates of the oscillograph, which would normally be connected to the condenser C and to the anode of the grid-controlled gas discharge tube T, is coupled by condenser D_1 at the point A between the resistance R and the impedance L/*r*. The other slow deflector plate of the oscillograph is con-

nected by condenser D_2 to the cathode K of the thyratron. Under these conditions, and for suitable values of r and of L, the characteristic of the voltage applied on the deflection plates is corrected, this voltage being composed of the ordinary

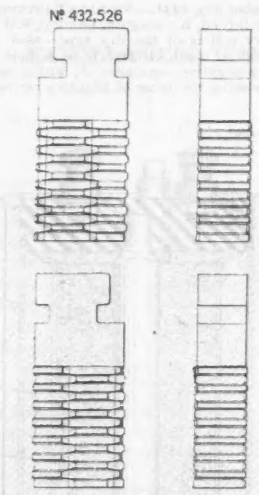


voltage existing at the terminals of the condenser C and of the supplementary voltage produced at the terminals of the impedance r, L. Suitable values for r and L are respectively 50,000 ohms and about 300 henrys for 25 periods.—*August 2nd*, 1935.

FURNACES.

432,526. February 25th, 1935.—FURNACE ARCHES, M. H. Detrick Company, 140, South Dearborn-street, Chicago, Ill., U.S.A.

This invention is concerned with the refractory tiles used in building up the suspended arches and side walls of furnaces, and has for its object a reduction in spalling. Spalling is,

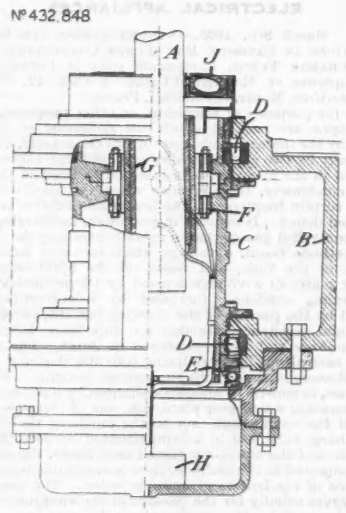


of course, produced by internal strains set up in the tiles, and when parts break away and fall off the adjacent tiles are exposed to more acute spalling. As a consequence, the inventors make their tiles with a number of interlocking projections, which prevent pieces falling out, but do not engage so tightly that the tiles are not free to expand and contract.—*July 29th*, 1935.

CRUSHING AND GRINDING.

432,848. January 18th, 1935.—A GYRATORY CRUSHING MILL, J. Meaux, 57, Rue de la République, Sées (Arne), France.

It is claimed that the capacity of this mill is practically double that of the usual type, as its speed can be increased from, say, 300 r.p.m. to as much as 500 r.p.m. The invention is concerned

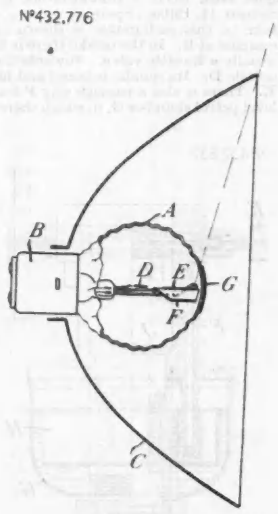


with the mechanism for producing the gyratory movement of the pendulous shaft A. B is a fixed casing in which there rotates the sleeve C, in the roller bearings D D. The weight is carried by the ball thrust E. Within the sleeve C there is mounted excentrically the ring F of a gimball bearing for driving the sleeve G. This sleeve can, consequently, follow the angular position of the main shaft A while giving it the necessary gyratory motion. An oil pump H provides lubrication for the rubbing surfaces, and a diaphragm J keeps out dust.—*August 2nd*, 1935.

LIGHTING AND HEATING.

432,776. October 29th, 1934.—INCANDESCENT LAMPS, *The General Electric Company, Ltd., Magnet House, Kingsway, London, W.C.2.*

This motor car headlight lamp is of the double-filament type, and although the auxiliary filament is of considerable length, is said to produce no glare in foggy weather. The lamp consists of the spherical or pear-shaped glass envelope A, and the bayonet cap B, which serves for securing the lamp in the holder —not shown—of the parabolic reflector C. The main filament D is arranged at or near the focus of the reflector and in front of this the auxiliary filament E. The auxiliary filament, together

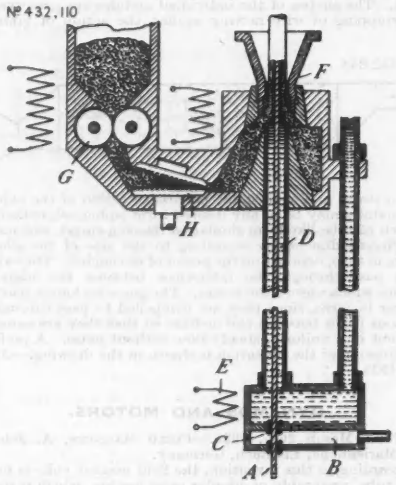


with the spade-like screening hood F, located below it, extend to within a few millimetres of the front of the envelope. The envelope is fluted. The leading-in wires for the two filaments serve at the same time for supporting them and for mounting the screening hood F, which is open towards the front and has no end wall. The front of the lamp has an opaque circular coating of paint or reflecting material G, which extends substantially to a line, shown dotted, forming the generatrix of a cone, connecting the edge of the reflector and the front end of the auxiliary filament, so that every point of the auxiliary filament can illuminate the whole upper half of the reflector C.—*August 1st*, 1935.

MISCELLANEOUS.

432,110. January 20th, 1934.—A METHOD OF APPLYING VULCANISED INSULATION TO CABLES, Electrical Research Products, Inc., 195, Broadway, New York, U.S.A.

This invention is concerned with the covering of electrical cables with vulcanised rubber compounds. The specification shows the whole of a machine for applying two layers of rubber to the cable, but the item of chief interest is the die shown in the drawing reproduced. The cable A is drawn upward through a chamber B and then through a die C into a vertical column D filled with a "pressure, equalising and impregnating material, such as partly depolymerised rubber," kept at a suitable tem-



perature by the heating coil E. It then goes through the extruding die F, which is supplied with the insulating mixture by the rollers G and gear pump H. A typical composition is as follows:—100 parts crepe rubber, 1 part sulphur, 1 part zinc oxide, ½ part stearic acid, ½ part D.P.G. (diphenyl guanadine), 3 parts Eureka G (aldehyde amine condensation product), 3 parts registered trade mark "Superla" wax (high melting petrolatum base wax), 2 parts registered trade mark "Neozone A" (phenyl alpha naphthyamine). The cable then passes through vulcanising and cooling processes, being kept in a vertical position, before going on to receive the second coating.—*July 22nd*, 1935.

LAUNCHES AND TRIAL TRIPS.

UMTATA, twin-screw steamship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Bullard, King and Co., Ltd., for their Natal Line; dimensions, 468ft. by 61ft. 3in. by 35ft. 6in.; to carry passengers and cargo. Engines, two sets triple-expansion engines in conjunction with an exhaust turbine on Bauer-Wach system, pressure 225 lb. per square inch; constructed by the builders at Neptune Engine Works; launch, August 30th.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

RAILWAY CLUB.—At Royal Scottish Corporation Hall, Fetter-lane, E.C.4. "Power-operated Signals," Mr. E. Wallis. 7.30 p.m.

TO-DAY AND SATURDAY, SEPT. 14TH.

ELMA LIGHTING SERVICE BUREAU.—2, Savoy-hill, London, W.C.2. Exhibition of Modern Lighting Methods. Daily.

TO-DAY TO SATURDAY, SEPT. 28TH.

SHIPPING, ENGINEERING AND MACHINERY EXHIBITION (INCORPORATING THE FOUNDRY TRADES EXHIBITION).—Olympia, London, W. Open 11 a.m. to 9 p.m. daily (except Sundays).

MONDAY, SEPT. 16TH, TO THURSDAY, SEPT. 19TH.

IRON AND STEEL INST.—Autumn meeting at Manchester. For provisional programme see page 189.

WEDNESDAY, SEPT. 18TH.

BELFAST ASSOC. OF ENGINEERS.—Visit to works of Dunville and Co., Ltd., Belfast. 7.30 p.m.

INST. OF MARINE ENGINEERS.—Official visit to the Shipping, Engineering and Machinery Exhibition at Olympia, London, W.

THURSDAY, SEPT. 19TH.

INST. OF LOCOMOTIVE ENGINEERS.—At Inst. of Mechanical Engineers, Storey's-gate, S.W.1. Presidential address, Mr. A. C. Carr. 5.30 p.m. for 6 p.m.

THURSDAY, SEPT. 19TH, TO SATURDAY, SEPT. 21ST.

NATIONAL SMOKE ABATEMENT SOC.—Seventh annual Conference at Bristol.

SATURDAY, SEPT. 21ST.

MANCHESTER ASSOC. OF ENGINEERS.—Visit to works of the Renold and Coventry Chain Company, Ltd., Burnage. 2.30 p.m.

MONDAY, SEPT. 23RD.

INST. OF MARINE ENGINEERS.—Autumn golf meeting at Shirley Park, East Croydon.

TUESDAY, SEPT. 24TH.

INST. OF MARINE ENGINEERS.—85, The Minories, E.C.3. Presidential address, Mr. Maurice E. Denny. 6 p.m.

WEDNESDAY, SEPT. 25TH.

INST. OF ELECTRICAL ENGINEERS: S. MIDLAND CENTRE.—Visit to the Coal Face Machinery Exhibitors' Assoc., Bingley Hall, Birmingham. Noon to 7 p.m.

INST. OF WELDING: N. WESTERN BRANCH.—At School of Technology, Manchester. "Gas-cutting of Metals Prior to Fabricating and Welding," Mr. W. Hart. 7.30 p.m.

THURSDAY, SEPT. 26TH.

CITY OF LONDON COLLEGE.—Ropemaker-street, Moorfields, E.C.2. Lecture, "Iron and Steel," the first of a course of twenty-four weekly lectures by Mr. T. Barton Kelly. 6–7 p.m.

SHEFFIELD METALLURGICAL ASSOC.—198, West-street, Sheffield, 1. Dance. 7–10.30 p.m.

TUESDAY, OCT. 1ST.

INST. OF AUTOMOBILE ENGINEERS.—At Royal Soc. of Arts, John-street, Adelphi, W.C.2. Presidential address, Mr. A. J. Hancock. 8 p.m.

SHEFFIELD METALLURGICAL ASSOC.—198, West-street, Sheffield, 1. "Measurement of Steel Corrosion," Dr. G. D. Bengough. 7.30 p.m.

TUESDAY, OCT. 8TH.

INST. OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—39, Elmbank-crescent, Glasgow, C.2. Presidential Address, Prof. P. A. Hillhouse. 6 p.m.

INST. OF MARINE ENGINEERS.—85, The Minories, E.C.3. "The Testing of Engineering Materials," Dr. H. J. Gough and Mr. W. J. Clenshaw. 6 p.m.

SHEFFIELD METALLURGICAL ASSOC.—198, West-street, Sheffield, 1. Extraordinary general meeting, 7 p.m. "Rolling of Steel," Mr. H. Williams. 7.30 p.m.

WEDNESDAY, OCT. 9TH.

INST. OF AUTOMOBILE ENGINEERS.—Metropole Hotel, Leeds. Presidential address, Mr. A. J. Hancock. 7.15 p.m.

THURSDAY, OCT. 10TH.

INST. OF AUTOMOBILE ENGINEERS.—At Merchant Venturers' Technical College, Bristol. Presidential address, Mr. A. J. Hancock. 7 p.m.

TUESDAY, OCT. 15TH.

ASSOC. OF SUPERVISING ELECTRICAL ENGINEERS.—At E.L.M.A. Lighting Service Bureau, 2, Savoy-hill, W.C.2. Presidential address. 7.15 p.m.

SHEFFIELD METALLURGICAL ASSOC.—198, West-street, Sheffield, 1. "The Testing of Steel Foundry Sands and its Practical Utility," Mr. T. R. Walker. 7.30 p.m.

THURSDAY, OCT. 17TH.

INST. OF AUTOMOBILE ENGINEERS.—At the Park-lane Hotel, Piccadilly, W.1. Annual dinner. 7.30 for 8 p.m.

THURSDAY, OCT. 17TH, TO SATURDAY, OCT. 26TH.

SOCIETY OF MOTOR MANUFACTURERS AND TRADERS, LTD.—Twenty-ninth International Motor Exhibition, Olympia. Open daily (except Sundays).

TUESDAY, OCT. 22ND.

INST. OF AUTOMOBILE ENGINEERS.—At George Hotel, Luton. Presidential address, Mr. A. J. Hancock. 7.30 p.m.

CONTRACTS AND ORDERS.

The Editor is always happy to print short announcements of contracts and orders in this column provided they are sent to him in time to have news value and that they are likely to interest readers.

ELLIOTT BROTHERS (LONDON), Ltd., have received an order from H.M. Office of Works for five sets of distance thermometer equipment for measuring air temperatures in various Government buildings in Whitehall, namely, the Admiralty, Colonial House, the Foreign Office, the Home Office, and the Treasury. Each of these equipments consists of a multi-point combined temperature indicator and selector switch, together with room-type resistance thermometers and a thermometer for outdoor air temperatures.